W. B. No. 90[illegible]

U. S. DEPARTMENT OF AGRICULTURE

WEATHER BUREAU

MONTHLY WEATHER REVIEW

VOLUME 54, No. 10

OCTOBER, 1926

WASHINGTON
GOVERNMENT PRINTING OFFICE
1926

OCTOBER, 1926

CONTENTS

†In marine separate.

CORRECTIONS

MONTHLY WEATHER REVIEW September, 1926:

Page 402, second table, White River, West Fork, opposite Elliston, Ind., for stage "27.4" read "28.8," and change the date to "14."

MONTHLY WEATHER REVIEW

Editor, ALFRED J. HENRY — Assistant Editor, BURTON M. VARNEY

Vol. 54, No. 10
W. B. No. 909

OCTOBER, 1926

CLOSED DECEMBER 3, 1926
ISSUED JANUARY 3, 1927

THE WEST INDIAN HURRICANE OF SEPTEMBER 14–22, 1926

By CHARLES L. MITCHELL

[With the collaboration of the Editor]

The tropical cyclone of September 14–22 was first observed on the morning of the 14th northeast of St. Kitts. On this date two other tropical cyclones were centered over the southern part of the North Atlantic, the first and more intense of the two being about 300 miles southwest of Bermuda, and the second, of little intensity, was slowly moving northeastward between Cuba and the Bahamas. This last-named soon lost whatever intensity it possessed at the time and could not be charted after the 17th.

The geographic position of these 3 disturbances at 8 a. m. 75th meridian time is shown in Figure 1 which also presents the 8 a. m. positions of the respective disturbances on the 15th, 16th, 17th and 18th; the 8 p. m. chart of the 17th is inserted in the series, as showing the barometric conditions immediately before the storm struck the Florida coast.

The third storm of the series with which this article is chiefly concerned was one of the most severe tropical cyclones or hurricanes that ever reached coastal United States, entailing a loss of life of 242 souls and an estimated property loss, in round numbers, of one hundred million dollars.

The course of this storm, on the average, was about 30 to 35° north of west; it passed almost directly over Grand Turk Island, very close to Nassau and struck the Florida coast at Miami after crossing the Gulf Stream at about its narrowest point. See Chart 14a, Figure 1. Its speed of movement varied somewhat. In the first 3 days subsequent to its appearance northeast of St. Kitts its center moved about 1,000 miles, or at the rate of about 14 m. p. h.; during the 24 hours previous to its arrival at the Florida coast it covered 450 miles at the rate of 18.75 m. p. h., an unusually rapid speed. During the next 2 days, when it was crossing southern Florida and northeastern Gulf of Mexico, a distance of about 550 miles, it traveled at the rate of only 11.5 m. p. h., while between 8 a. m. of the 20th and 8 a. m. of the 21st the center advanced only about 150 miles or at the rate of 6.25 m. p. h. These figures may be in error to a slight degree because of lack of meteorological reports from oceanic areas and the resulting uncertainty of the location of the center of the storm.

I present in the table below the data of the storm within a radius of 500 miles of its center as received from land and sea stations by radio and cable and available to the forecaster in predicting the future movement of this storm. The notable feature of this table is the small number of reports from oceanic areas and this is strikingly manifest for the 17th—the critical date. It may be that the advance notice of the presence of the storm deterred vessel masters from entering the storm area; in any event the absence of reports from oceanic areas at critical times must be a serious handicap to any organization that attempts to forecast the coming of these destructive storms.

TABLE 1.—*Synoptic data for the West Indian hurricane of September 14–22, 1926*

Date	Stations	Sea-level pressure	Temperature	Wind		State of weather
				Direction	Force (Beaufort)	
		In.	F.			
Sept. 14, 8 a. m.	St. Kitts	29.78	74	NW	1	Cloudy.
	St. Thomas	29.82	82	N	4	Partly cloudy.
14, 8 p. m.	St. Kitts	29.70	80	W	2	Rain.
	St. Thomas	29.74	------	N	5	Cloudy.
15, 8 a. m.	St. Kitts	29.84	74	SW	5	Cloudy.
	St. Martins	29.76	------	S	7	Rain.
	St. Thomas	29.66	74	SW	8	Rain.
	San Juan	29.74	82	W	5	Cloudy.
15, 8 p. m.	St. Thomas	29.80	82	SW	7	Cloudy.
	San Juan	29.72	78	S	3	Rain.
	Santo Domingo	29.76	92	NW	1	Cloudy.
	Turks Island	29.90	90	NE	3	Clear.
16, 8 a. m.	St. Thomas	29.92	72	SE	4	Cloudy.
	Santo Domingo	29.76	72	SW	2	Cloudy.
	Puerto Plata	29.72	74	W	3	Rain.
	Turks Island	29.74	70	NW	4	Cloudy.
11.20 a. m.	Turks Island	29.62	72	NW	7	Cloudy.
1 p. m.	Turks Island	29.26	68	NW	12	Cloudy.
16, 8 p. m.	Santo Domingo	29.78	92	S	3	Cloudy.
	Puerto Plata	29.62	82	S	3	Cloudy.
	Inagua	29.64	82	NW	7	Cloudy.
	U. S. S. Kittery (20°.1 N. 72°.3 W).	29.64	88	SW	6	Cloudy.
	S. S. Gulf Trade (24°.3 N. 74°.3 W).	29.82	82	NE	5	Rain.
17, 8 a. m.	Puerto Plata	29.78	76	SE	4	Partly cloudy.
	Baracoa	29.72	80	S	2	Cloudy.
	Gibara	29.76	76	SW	2	Rain.
	Camaguey	29.74	76	NW	2	Clear.
	Nassau	29.72	84	NE	5	Partly cloudy.
	S. S. Scantic (26°.3 N. 74°.2 W.).	29.90	84	E	7	Partly cloudy.
10 a. m.	Nassau	29.64	86	NE	7	Partly cloudy.
12 noon.	Gibara	29.68	86	SSW	3	Cloudy.
1 p. m.	Nassau	29.56	86	N	9	Cloudy.
17, 8 p. m.	Gibara	29.76	86	S	2	Cloudy.
	Camaguey	29.68	84	SW	4	Rain.
	Tunas	29.70	------	W	6	Cloudy.
	Cienfuegos	29.66	90	W	3	Rain.
	Havana	29.72	90	NW	4	Partly cloudy.
	Key West	29.68	84	NE	3	Cloudy.
	Miami	29.68	82	NE	4	Cloudy.
	S. S. La Playa (26°.4 N. 79°.7 W.).	29.74	82	NE	6	Cloudy.
18, 8 a. m.	Key West	29.50	82	NW	7	Cloudy.
	Fort Myers	29.46	82	NE	6	Cloudy.
	Havana	29.64	80	SW	4	Cloudy.
	Tampa	29.68	80	NE	5	Cloudy.
	S. S. El Oceana (29°.3 N. 79°.5 W.).	29.66	86	NE	9	Rain.
	S. S. Scantic (25°.7 N. 76°.6 W.).	29.88	82	SE	7	Cloudy.
	Miami (received next day).	27.94	------	SE	9	Rain.
12 noon.	Fort Myers	29.04	76	N	9	Rain.
4 p. m.	Tampa	29.42	78	NE	7	Rain.

THE HURRICANE APPROACHES THE FLORIDA COAST

A special observation made at Nassau at 1 p. m. on the 17th was the last and only observation received from the region east of Miami and Key West on that date. At the 8 p. m. observation of the 17th both of these stations reported a barometer reading of 29.68 inches, with northeast wind, 18 m. p. h. at Miami and 12 at Key West; furthermore, both stations reported no material change in pressure within the last 2 hours. The lack of information from the region to the eastward of Florida and the rather disconcerting reports of little pressure

change at the two stations named placed the forecaster in a very difficult position. With night already on and no chance of awaiting special reports from Miami, he had to rely on his previous deductions made Friday morning, which placed the hurricane center near Miami at 8 a. m. Saturday morning; therefore, with no indications whatever of a recurve in the path of the hurricane, the storm warnings were changed to hurricane warnings at 11 p. m. of the 17th from Key West to Jupiter Inlet, and northeast storm warnings were ordered north of Jupiter to Titusville and on the west Florida coast from Key West to Punta Gorda.

A chronological list of the most important warnings issued in connection with this storm is given in a later section of this report.

The center of the hurricane reached the Florida coast at Miami about 6 a. m. September 18. That the "eye" of the storm passed directly over the Weather Bureau office in Miami is clearly shown in Figure 2, the latter being a reproduction of the record of wind direction and speed as automatically recorded in that office for the hours 5 to 8 a. m. September 18, within which time the "eye" of the storm passed the station.

It is shown thereon that the strong northeast winds diminished and at 6:10 a. m. became variable, at first shifting to the southeast and for the next 35 minutes momentary winds from all directions were recorded but in the main they were from the southeast at velocities of 10 to 12 miles per hour. At this time the people of Miami, thinking the storm was over, ventured into the streets, as told herein later by Mr. Gray, some of whom doubtless lost their lives by so doing.

After the lull the wind went to the southeast and increased in speed and at 9 a. m. of the 18th it became southwest and continued in that direction until well after the storm had passed.

At the end of this report is given a short account of an extraordinary wind experienced at Jupiter Inlet, about 80 miles north of Miami, as late as 8 p. m. of the 18th.

At the time of the passage of the "eye" of the storm, Miami was doubtless in or near the northern edge thereof since at Homestead 28 miles to the south, the lull was of but 5 minutes duration.

The record of rainfall and temperature during the passage of the "eye" was lost due to the recording instruments being blown away. Below is the narrative of R. W. Gray, the official in charge of the station.

Miami, Fla.—The first information concerning the storm was received from the central office at 11:30 a. m. of the 14th. No vessels bound for the Bahamas left Miami after that date. Advisory messages relative to the intensity and progress of the storm were received at regular intervals from the 15th to the 17th, inclusive, and these advices were given such wide distribution that it can be safely said that the entire population of the lower east coast of Florida was informed of the approach of the storm.

Northeast storm warnings were displayed, by order of the central office, at noon of the 17th. The afternoon newspapers published the warning, and it was otherwise disseminated by telephone and telegraph. From the early afternoon of the 17th until the wires were blown down, telephone calls at the Weather Bureau office were answered at the rate of two to three per minute. In addition to the telephone service from the Weather Bureau, the Miami Daily News kept a special telephone operator on duty to give information to those who did not succeed in getting telephone connection with the Weather Bureau. A representative of the News remained at the Weather Bureau office throughout the night of the 17th–18th and kept his paper informed of all available information until telephone connection was severed.

The message ordering hurricane warnings at 11 p. m. of the 17th was received at 11:16 p. m. The warning was displayed from the roof of the Federal Building at 11:25 p. m., and from the storm warning tower at the city docks, one and one-half miles from the Weather Bureau office, at midnight.

Before leaving for the storm-warning tower, I gave the hurricane warning to the long distance telephone operator, who repeated it to the telephone exchanges at Homestead, Dania, Hollywood, and Fort Lauderdale. The warning was also telephoned to the chief dispatcher of the Florida East Coast Railroad, and several efforts were made to get telephone connection with Fowey Rock Lighthouse and the Coast Guard base at Fort Lauderdale. Telephone communication had not been interrupted, but the operator reported that repeated calls failed to get any response from Fowey Rock or the Coast Guard station. Shortly after 10 p. m. I began to give out the information that the rapid fall of the barometer and the direction and increasing velocity of the wind indicated that the storm was rapidly approaching this coast, and that, unless it recurved to the east of Miami, winds of hurricane force might be expected. This information continued to be given by telephone until the receipt of the hurricane warnings at 11:16 p. m. After that time all persons calling by telephone or in person were informed of the display of hurricane warnings. Telephone communication with Hollywood and Miami Beach was severed between 1 a. m. and 2 a. m., and in Miami between 2 a. m. and 3 a. m.

The hurricane came with great suddenness. Except for a moderate but steady fall of the barometer after 10 a. m. of the 17th, there were no unusual meteorological conditions to herald the approach of the storm. The wind velocity as late as 8 p. m. of the 17th was only 19 miles per hour, and the usual heavy rain that precedes a tropical storm did not set in until after midnight, by which time the wind was blowing a fresh gale. At 10 p. m. of the 17th the barometer began to fall rapidly, and by midnight it had fallen 0.11 inch. From midnight to 6:45 a. m., at which time the center of the storm passed over Miami, there was a precipitate fall at the rate of 0.28 inch per hour. * * * From about 5:30 to 6:10 a. m. the barometer fell 0.40 inch and then remained stationary for 15 or 20 minutes. This was at the beginning of the lull in the wind that attended the arrival of the center of the storm. After the short stationary period there was another rapid fall of 0.06 inch, and at 6:45 a. m. a reading of the mercurial barometer showed a pressure of 27.61 inches. * * * After the passage of the center of the storm, the barometer rose even more rapidly than it had fallen, and by noon it had reached 29.30 inches.

The center of the storm passed over the central and southern parts of Miami. Over the extreme northern part of the city and over the northern part of Miami Beach the wind shifted from northeast to south, but there was no pronounced lull. At the Weather Bureau office the wind fell to 10 miles per hour at 6:30 a. m. At the same time the velocity at the Allison Hospital, 6¼ miles northeast of the Weather Bureau office in the northern part of Miami Beach, was 80 miles per hour. Ten minutes before, the velocity had been 108 miles.[1]

The wind increased steadily from the northeast after 10 p. m.

At 1:50 a. m. the anemometer recorded a velocity of 41 miles, indicating a true velocity of about 57 miles per hour. Telephone communication with Miami Beach ceased shortly before this time. By 2:35 a. m. the true velocity had increased to 60 miles per hour, and by 3 a. m. telephone service in Miami had ended. There was a steady increase in wind velocity from that time to 5 a. m. when the anemometer recorded a maximum velocity of 80 miles, indicating a true velocity of at least 115 miles per hour. The top of the raingage blew off at 3:42 a. m., and was recovered and replaced by the assistant at this station. It was again blown off a few minutes later and lost. A part of it was found the next day on the roof of a nearby building. The electric light wires were blown down at 4 a. m., and the observations during the remainder of the night were made with a flashlight, supplied by one of the visitors who spent the night at the Weather Bureau office. Frequent flashes of electricity from fallen wires added to the fearful aspect of the elements. The instrument shelter blew away between 4 a. m. and 5 a. m., landing in the street below and crashing into the automobile of a *Miami Daily News* staff writer who was on duty at the Weather Bureau office. There was an abrupt decrease in the wind velocity between 6:10 a. m. and 6:15 a. m., when the center of the storm reached Miami (see Fig. 2). Many persons who had spent the night in down-town buildings rushed out to

[1] Mr. B. C. Kadel, Chief of the Instrument Division, informs the editor that the anemometer here mentioned was supplied by Friez of Baltimore and that it is one of the new three-cup pattern anemometer developed by J. Patterson of the Canadian Meteorological service in collaboration with U. S. Weather Bureau officials, and, further, that this form of anemometer at the speeds named registers very close to the true velocity and that the maximum of 128 m. p. h. is equivalent to a velocity of 160 m. p. h. as registered by the 4-cup Robinson anemometer.

The disparity between the wind velocities at the two exposures mentioned is therefore greater than the figures would indicate; this is due to the blanketing effect of recently erected high buildings which almost completely surround the three-story Federal office building in which the Weather Bureau office is housed. These buildings rise to 8 and, in one case, 18-stories; one 15-story building stands not more than 100 feet east-northeast of the Weather Bureau exposure. It so happens that plans for a change in location were under consideration at the time the disaster occurred. See Mr. Kadel's analysis of the Allison Hospital wind record following this article.—Ed.

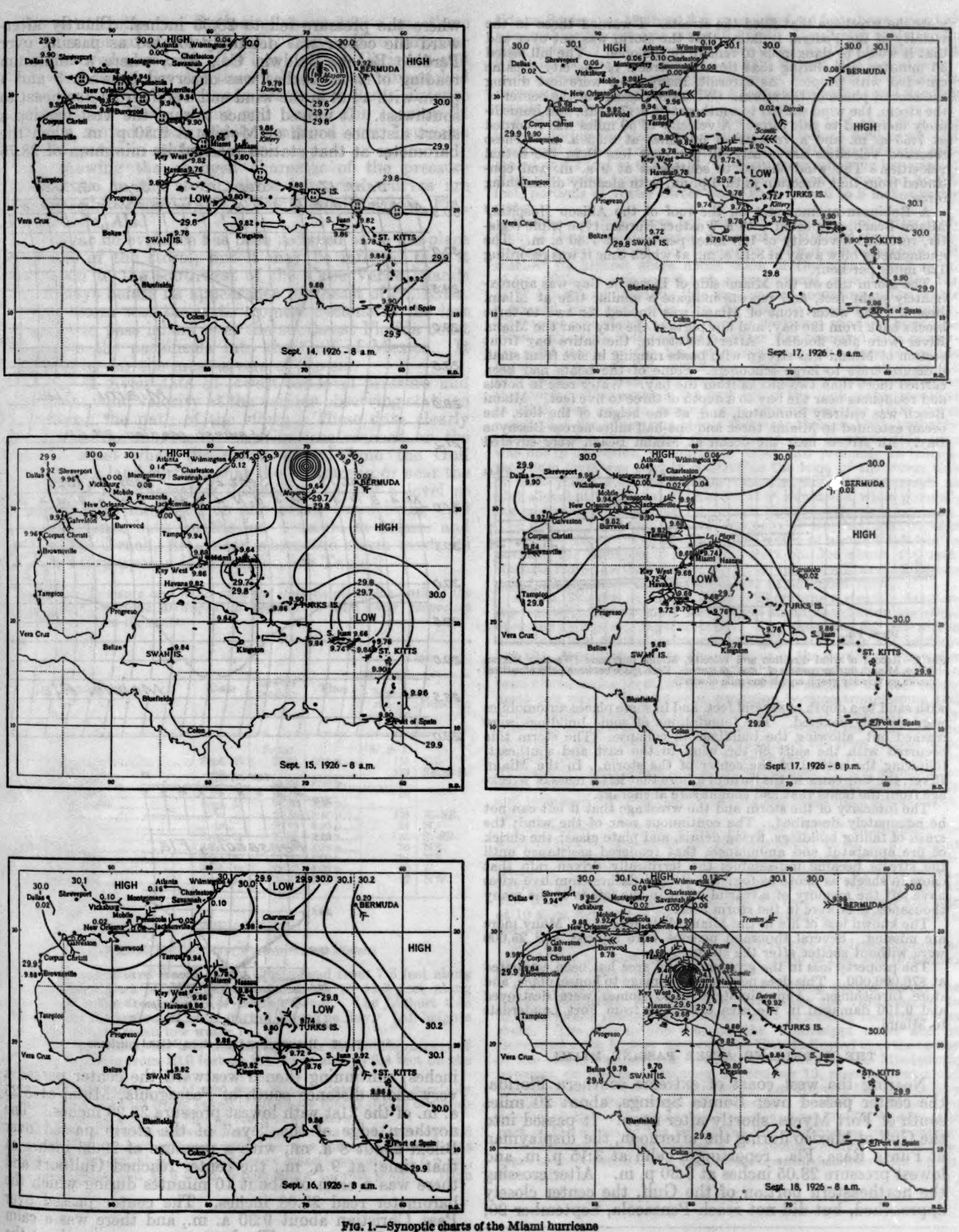

FIG. 1.—Synoptic charts of the Miami hurricane

view the wreckage that filled the streets. I warned those in the vicinity of the Federal Building that the storm was not over and that it would be dangerous to remain in the open. The lull lasted 35 minutes, and during that time the streets of the city became crowded with people. As a result, many lives were lost during the second phase of the storm. With the passage of the center of the storm, the wind shifted to southeast at 6:47 a. m., and immediately increased to gale force. A velocity of 50 miles was recorded at 7:55 a. m. and a velocity of 60 miles at 8:55 a. m. These recorded velocities are nearly 50 per cent less than the actual velocities. The wind shifted to southwest at 9 a. m. and continued from that direction until 6 p. m., with steadily diminishing force.

A Robinson anemometer on the roof of the Allison Hospital,[3] Miami Beach, connected with a Weather Bureau type triple register, recorded a velocity of 128 miles per hour at 7:30 a. m. The anemometer blew away at 8:12 a. m., at which time it was recording 120 miles per hour.

The storm tide on the Miami side of Biscayne Bay was approximately eight feet, and reports indicate a similar tide at Miami Beach. The water front of Miami was flooded for two to three blocks back from the bay, and low parts of the city near the Miami River were also flooded. After the storm, the entire bay front section of Miami was strewn with boats ranging in size from small pleasure craft to large schooners. Some of the boats had been carried more than two blocks from the bay. Water rose in hotels and residences near the bay to a depth of three to five feet. Miami Beach was entirely inundated, and, at the height of the tide, the ocean extended to Miami, three and one-half miles across Biscayne Bay. All streets near the ocean at Miami Beach were covered

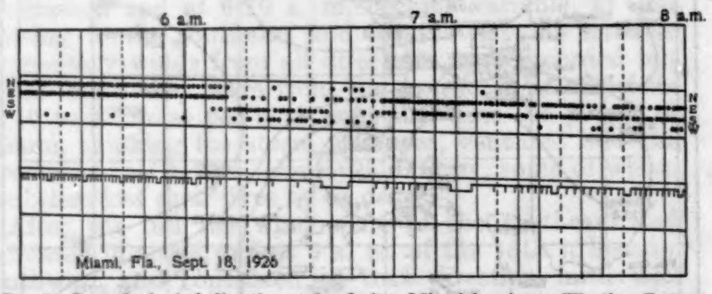

FIG. 2.—Record of wind direction and velocity, Miami hurricane (Weather Bureau Office, Miami, during passage of "eye" of storm. Each space between pairs of vertical marks on velocity graph equals one mile of wind)

with sand to a depth of several feet, and in some places automobiles were entirely covered. The foundations of some buildings were washed out, allowing the buildings to collapse. The storm tide occurred with the shift of the wind to the east and southeast, following the arrival of the center of the storm. In the Miami River, the tide came in the form of a bore that left a mass of wreckage from the boats that had sought safe anchorage.

The intensity of the storm and the wreckage that it left can not be adequately described. The continuous roar of the wind; the crash of falling buildings, flying débris, and plate glass; the shriek of fire apparatus and ambulances that rendered assistance until the streets became impassable; the terrifically driven rain that came in sheets as dense as fog; the electric flashes from live wires have left the memory of a fearful night in the minds of the many thousands that were in the storm area.

The known loss of life in the Miami district is 114. Many more are missing. Several thousand persons were injured, and 25,000 were without shelter after the storm.

The property loss in the greater Miami area has been estimated at $76,000,000. This does not include damage to house, office, and store furnishings. Approximately 4,725 homes were destroyed and 9,100 damaged in the area extending from Fort Lauderdale to Miami.

THE HURRICANE AFTER PASSING MIAMI

Nearing the west coast of extreme southern Florida, the center passed over Bonita Springs, about 20 miles south of Fort Myers, shortly after noon. It passed into the Gulf of Mexico during the afternoon, the displayman at Punta Rasa, Fla., reporting a calm at 3:15 p. m. and lowest pressure 28.05 inches at 3:30 p. m. After crossing the northeastern portion of the Gulf, the center closely approached, but did not reach Pensacola, September 20, where the pressure fell to 28.56 inches. Shortly afterward the center was definitely located as passing over Perdido Beach, Baldwin Co., Ala., where a minimum reading of 28.20 inches was observed between 3 and 4 p. m. with a lull in the wind and a shift from northeast to southwest. It moved thence toward the west passing a short distance south of Mobile at 9:30 p. m. when the barometer at that station reached its minimum of 28.76

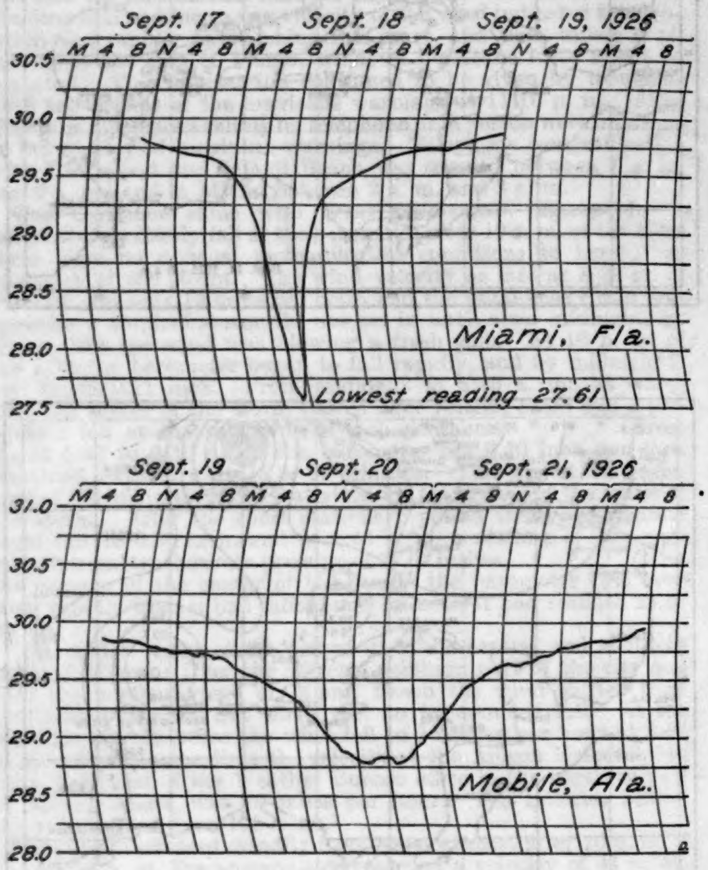

FIG. 3.—Barograms at three cities, Miami hurricane

inches; continuing thence westward the center passed a very short distance south of Pascagoula, Miss., at 5:25 a. m. of the 21st with lowest pressure 28.99 inches. The northern edge of the "eye" of the storm passed over Biloxi about 8 a. m., with a pressure of 29.03 inches at that time; at 9 a. m., the center reached Gulfport and there was a calm of about 10 minutes during which the barometer read 29.08 inches. The center passed over Pass Christian about 9:30 a. m., and there was a calm of about 30 minutes. The lowest pressure was about the

[3] See footnote 1.

same as at Gulfport. Beginning about 9:30 a. m., there was calm for an hour at Bay St. Louis. The hurricane center moved over land after leaving Pass Christian and Bay St. Louis. By this time it had greatly diminished in intensity. At 8 p. m. the center was some distance northwest of New Orleans and during the ensuing 24 hours it moved more rapidly westward over Louisiana and dissipated in eastern Texas.

As showing the changed character of the pressure distribution in the storm, three barograph curves are reproduced in Figure 3, viz, Miami, and Pensacola, Fla., and Mobile, Ala.

Thus far no evidence has been received as to the place of origin of the storm, but it may be inferred that it developed to the southwest of the Cape Verde Islands 6 or 7 days before its appearance northeast of St. Kitts.

This storm was the sixth tropical cyclone in the last 40 years to pass inland over the southeast Florida coast and cross the peninsula into the Gulf of Mexico. It was also by far the most severe of the six.

Below is given data of lowest sea-level pressure and maximum wind velocity at the various observing stations in or near the path of the storm. These data clearly show that the maximum intensity was reached on the Florida coast when the storm passed from the Gulf Stream to a land surface, that the pressure in or near the center did not thereafter descend to so low a level as where it first impinged on the coast, there being 0.59 inch difference between the low pressure at Miami and at Perdido Beach, Ala., near where the storm made its second entry upon a land surface, see Table 2.

Table 2.—*Pressure and wind data for stations along the path of the hurricane, stations arranged in accordance with their respective distances from the center*

Stations	Date	Lowest pressure	Time	Wind: Maximum velocity	Wind: Direction
		Inches		*M. p. h.*	
Miami, Fla.	Sept. 18	27.61	6:45 a.	115	NE.
Miami Beach, Fla.	do			128	SE. or E.
Punta Rasa, Fla.	do	28.05	3:30 p.		
Fort Myers, Fla.	do	28.14		[1] 80	
Perdido Beach, Ala.	Sept. 20	28.20	3:30 p.		
Pensacola, Fla.	do	28.56	3:10 p.	116	E.-SE.
Mobile, Ala.	do	28.76	9:30 p.	94	N.
Gulfport, Miss.	Sept. 21	29.08	8:30 a.	[1] 55	S.-SE.
Tampa, Fla.	Sept. 18	29.36	5:30 a.	50	NE.
Apalachicola, Fla.	Sept. 19	29.57	5:00 a.	64	NE.
Jacksonville, Fla.	Sept. 18	29.77	4:00 p.	50	E.
New Orleans, La.	Sept. 21	29.47	2:00 p.	27	NW.

[1] Estimated.

STORM TIDES

(Excerpts from reports of Weather Bureau officials)

Miami and Miami Beach.—The tide ranged from 7.5 feet along the northern part of the Miami water-front to 11.7 feet along the lower water-front south of Miami River. The highest tide occurred in the lower and wider part of Biscayne Bay. (All heights given are above mean low water.)

At Miami Beach, the tide was highest over the southern part of the city, ranging from 10.6 feet on the ocean side to 6.4 feet on the bay side.

All measurements at Miami and Miami Beach were carefully made, most of them being taken from water marks inside of buildings, where the action of the waves was not shown.

Tampa.—The tide was very low, being driven out of the bay and river by the strong northeast winds, as was the case in 1910. At 3 p. m. of the 18th it was 0.8 feet below mean low water, at 6 p. m., 4.0 feet below, and at 9 p. m. 6 feet below (lowest point). High tide on September 19 about 2 p. m. reached 4.5 feet above mean low tide, making the extreme range 10.5 feet. It was high again on the 20th, being 3.9 feet above mean low tide. In 1910 the tide went 8 feet below mean low tide, and in 1921 it went 10.5 feet above.

Fort Myers.—High water accompanied the storm, according to newspaper reports, reaching 4 to 6 feet above normal and flooding certain sections of the city.

Apalachicola.—The tide was down to −0.4 foot at 6:30 a. m.; it rose during the day, 20th, reaching 3.4 feet at 6:30 p. m. and continued to rise during the night. On the 21st the tide was estimated at 4.2 feet at 6:30 a. m.; it was then overflowing low ground along the water front with highest waves running possibly to 5.0 feet, portions of Water Street being then from 6 to 8 inches under water.

Pensacola.—Tides were but little above normal until after midnight of the 19th–20th, and at 2 a. m. of the 20th the stage was only 1.3 feet above normal, but thereafter the water rose rapidly and reached its highest stage about noon of the 20th. At 7 a. m. of the 20th the tide was 5 feet above normal, at which time the U. S. Coast and Geodetic tide gage ceased recording. The water remained high until after 2 p. m. when it receded considerably. The water rose steadily in the face of northeast winds of hurricane force, indicating that the storm center was preceded by a moderate tidal wave, as the highest water occurred before the winds became true southeast, or off the Gulf. The high stage of 9.4 feet above mean sea level has been accurately determined since the storm. This stage is 0.6 foot below the high water recorded in 1906, but reliable persons who experienced the 1906 storm assert that the water was higher this year than in 1906, probably by two feet. The United States Coast and Geodetic tide gage was not in operation, of course, in 1906, and probably an inaccurate base level was used in computing the level of the storm tide of that year. Reports indicate that the tide did not reach as high a level at the Naval Air Station as at Pensacola, while proceeding eastward in Pensacola Bay much higher levels were reported. The Bagdad Land and Lumber Company at Bagdad, Fla., reports a tide of 14 feet. Valparaiso reports a tide of about 4 feet above normal; St. Andrews, 6 feet; and Port St. Joe about 4½ feet. Reports from the Gulf Beach, about 20 miles southwest of Pensacola indicate that no high water was experienced there.

Mobile, The tide in Mobile River.—There was a steadily decreasing tide with the northerly winds until an unprecedented low stage occurred at 2 p. m., September 21. The water was 0.5 foot above mean low tide on the harbormaster's gage at 11:30 p. m., September 19. Measurements by the observer of the depths of the water at points of the river bottom reported by different parties as having been above water level indicate a minimum stage of 9.7 feet below mean low tide. This unusual condition became troublesome and caused slight damage to boats that had sought shelter at Twelve Mile Island, upriver from Mobile, as it increased the height of the river bank above water, and the swaying of the trees caused large sections of ground with timber to slide into the river. The tide was reported to be rising at 1 a. m., September 21, and a maximum stage of 5.3 feet was reached at 11 a. m. It fluctuated slightly and remained within a foot of the highest stage until about nightfall.

Gulfport.—* * * At 9:30 a. m., after a lull of 10 minutes, the wind shifted to east-southeast and was about 15 m. p. h. It did not change much until 11:15 a. m., when it began to veer and increase in velocity. It was from the southwest by 6:15 p. m., having reached a velocity of about 55 miles p. h. from the SSE at 2:30 p. m. The tide fell and it was 3.8 feet below mean low tide at 10 a. m. September 20. It rose on September 21 and reached a maximum of 6.0 feet at 1:15 p. m.

Bay St. Louis.—* * * The tide was very low from September 17 to 9:15 a. m. September 21, when it began to rise, and it reached about 3 feet above normal.

New Orleans.—* * * The storm having moved across the Florida Peninsula, the length of fetch over the Gulf needed to develop swells that would produce tides preceding the storm was short. The rise in the tide on the Mississippi coast and at Burrwood up to Sunday morning, the 19th, indicated that the center of the storm was moving toward the mouth of the Mississippi; however, on Sunday afternoon, September 19, reports from along the Mississippi coast and Burrwood, La. showed the tide falling at all points. From these and attendant weather conditions, we concluded that the whole coast eastward to Mobile was in that part of the storm to the left of the line of advance of the center. Our judgment on this matter was therefore embodied in a telegram to the Central Office which was forwarded shortly after 4 p. m. September 19.

DISTRIBUTION OF WARNINGS OF SEVERE STORMS

General distribution.—Hurricane and other warnings of severe storms are telegraphed or cabled from the Central Office of the Weather Bureau in Washington direct to officials in charge of principal and substations of the Bureau in the districts affected; also to the radio broadcast stations at Brownsville, Tex., New Orleans, La., and Key West, Fla., for radio broadcast at those points.

The Navy Department (Communications Office for Arlington) also receives a copy of warnings of all severe storms. The weather bulletin broadcast daily by the Arlington station (NAA) includes in addition to the weather data warnings of severe storms as issued by the Weather Bureau.

Press associations are also supplied with telegraphic advices of storm warnings.

Advices of the coming of the hurricane, in the present case, were perhaps as widely, if not more widely distributed than ever before due to the multiplication of radio broadcasting stations. The radio service at New Orleans, in particular, was especially effective, one station broadcasting hourly bulletins.

Space does not permit mention of the valuable services of individuals and organizations in spreading the warnings and the subsequent advices as issued.

Below is given copies of the more important warnings issued; the arrangement is chronological.

September 15, 10:02 a. m.—Tropical disturbance reported northeast of St. Kitts Tuesday morning has moved directly westward. Now centered short distance north St. Thomas, Virgin Islands. This storm has already attained considerable intensity.

September 16, 3 p. m.—Center of hurricane of great intensity passing near Turks Island which reports wind one hundred miles from northwest. Hurricane center will pass near or slightly north of Crooked Island, Bahama group, Friday forenoon. Greatest caution advised vessels bound for Bahama group and adjacent waters.

September 16, 9:30 p. m.—Third tropical storm has passed Turks Island moving west-northwestward attended by dangerous shifting gales. Caution advised vessels bound for Florida Straits, Bahamas and adjacent waters.

September 17, 10:20 a. m.—Hoist northeast storm warning twelve noon Jupiter Inlet to Key West. Hurricane central about twenty-three north seventy-four west moving west-northwestward attended by winds hurricane force near center. This is a very severe storm. Its center will likely pass near Nassau early tonight. Great caution advised all vessels bound Florida Straits, Bahama Islands, and east Florida coast. Every precaution should be taken for destructive winds Saturday morning especially Jupiter to Miami.

To the Governor General, Nassau, Bahamas, the following message was sent:

September 17, 10:02 a. m.—Please send special observations every two hours to-day. Hurricane central near and north Crooked Island and its center will likely pass near Nassau early to-night. This is a destructive storm.

September 18, 1:30 p. m.—Hoist northeast storm warning 4 p. m. north of Jacksonville to Charleston and west of Mobile to mouth of Mississippi River. Hurricane center noon over extreme southern Florida, Fort Myers reporting barometer 29.04, wind fifty-two miles north. Hurricane will pass into Gulf of Mexico this afternoon and continue to move west-northwestward for the present. This is a very severe storm. Greatest caution advised vessels in its path.

September 18, 9:45 p. m.—Change to hurricane warning 11 p. m. Apalachicola, Fla., to Burrwood, La. Hurricane central between twenty-six and twenty-seven north and about eighty-three west moving west-northwestward attended by winds of hurricane force. This is a very severe storm. Unless course changes hurricane center will move inland, most likely between Pensacola and mouth of Mississippi River Sunday night. Emergency. Every precaution should be taken against destructive winds.

September 19, 10 a. m.—Advisory 10 a. m. Hurricane apparently central between twenty-seven and twenty-eight north and about eighty-five west moving west-northwestward attended by dangerous shifting gales. Unless course changes hurricane center will move inland late to-night between Pensacola and mouth of Mississippi River, probably nearer the latter. Further advices this afternoon. Meanwhile every precaution should be taken against destructive east and northeast winds beginning to-night all points where hurricane warnings are displayed.

September 19, 2.30 p. m.—At 2:30 p. m. of the 19th the following advisory warning was sent to all stations from Apalachicola to Burrwood, inclusive, and hurricane warnings were ordered continued at 11 p. m. at all display stations within this area:

Noon specials indicate hurricane center near twenty-eight north eighty-six west moving west-northwestward. This is a hurricane of great intensity and magnitude and emphasis should be placed on need of every possible preparation for destructive winds, especially Pensacola to mouth of Mississippi River. Hurricane center will likely pass inland late to-night or Monday morning.

Then the final advisory before the hurricane center approached the coast was as follows:

September 19, 9:30 p. m.—Advisory 9:30 p. m. Hurricane central about twenty-nine north eighty-seven west apparently moving northwestward. Hurricane center will pass inland early Monday morning, probably not far from the Pensacola-Mobile section.

The local distribution.—Each local Weather Bureau station in the storm area distributes the warnings by telephone directly to all persons and organizations that have vital interests to be served. In urgent cases such other means of quick personal distribution as are available are utilized. In the present case the Tampa official enlisted the services of the local Boy Scout organization. Other officials took advantage of such means as were at hand, but in the main chief reliance is placed on the telephone, the radio, and the daily local press.

Special acknowledgement is made to the *Mobile Register* for issuing a special edition on Sunday, September 19, giving the latest information respecting the hurricane. Space does not permit a recital of the details of the local distribution at the various Weather Bureau stations in the storm-stricken area; suffice it to say that each and every employee was faithful to the trust imposed in him, and made the widest distribution humanly possible.

AN INTERPRETATION OF THE WIND VELOCITY RECORD AT MIAMI BEACH, FLA., SEPTEMBER 17-18, 1926

By BENJAMIN C. KADEL, in charge of Instrument Division

[U. S. Weather Bureau, Washington, D. C.]

Dr. Scott R. Edwards, superintendent of Allison Hospital, Miami Beach, Fla., has kindly furnished to the Weather Bureau, through R. W. Gray of the Miami office of the Weather Bureau, a record of the wind movement at Miami Beach about 4 miles east of the city of Miami during the hurricane of September 17 and 18, 1926. The hospital is three-fourths of a mile north of the northern limit of the center of the hurricane. The anemometer, a 3-cup Robinson anemometer, cups 5 inches in diameter on arms 6.29 inches long, factor 2.50, was exposed 19 feet above the roof and 40 feet above the ground, the ground being 5 feet above mean sea level. It was on the eastern or ocean side of the hospital roof, about 1,200 feet from the ocean, and freely exposed to wind from all directions. The anemometer was equipped to close an electrical circuit for each mile of travel of the wind, the 9th and 10th miles being connected together to aid in identification of the record.

The record was made on a standard Weather Bureau pattern meteorograph, variously called triple register or

quadruple register, which is a simple chronographic recorder having a chart speed of 2½ inches per hour. A record sheet that had been used for testing was employed, and while the sheet was not placed on the instrument in exactly the customary manner, the time has been indicated in pencil notation by Dr. F. J. Payton of the hospital staff. Careful examination of the record shows smooth uniform motion of the cylinder throughout the period, except for two slight jogs in the line during the last three-fourths hour, which indicate some slight readjustment. With these two unimportant exceptions the record is entirely automatic. The instruments were recently purchased from Julien P. Friez and Sons, who regularly manufacture such equipment for the Weather Bureau, and who are familiar with all the requirements. There is every reason for full and complete confidence in the record.

The record shows that the wind increased gradually from 29 miles per hour at 9 p. m. of the 17th, reaching 100 by 4.30 a. m. of the 18th, and continuing above 100 to a peak of 114 at 6:10 a. m., after which there was a slight decrease to a minimum rate of 78 at 6:25 a. m.; this comparatively low rate lasted but 5 minutes, the wind increasing again to above 100 and reaching a 5-minute maximum of 128 by 7:30 a. m., after which the rate continued above 120 until the anemometer blew away at 8:12 a. m.

The rates above given are for periods of 5 minutes, and are subject to the following small instrumental corrections: At 40, −2; at 60, −3; at 80, −4; at 100, −5; at 120, −5; at 130, −5; at 140, −6. There are several instances on the record of higher rates maintained for two adjacent miles, the highest being 138 at 7:40 a. m. A still higher rate for one mile at 7:43 a. m. has been discarded because the longer mile just preceding it indicates possible disturbance of the record cylinder. It has been customary for many years to use 5-minute velocities in Weather Bureau records and publications because of recognized difficulty in interpretation due to irregular movement of the cylinder, inequalities in length of contacts, and particularly the inertia of the cup wheel in gusty wind. For comparisons with other 5-minute records it is desired to state that the 5-minute maximum of 128 means a true velocity of 123 after applying the correction for this form of anemometer determined in the wind tunnels of the Bureau of Standards (*1*). If this wind had been measured by the well-known 4-cup anemometer, the indicated record would have shown 163 as the 5-minute maximum and 183 as the extreme.

The indicated extreme velocity of 138, maintained for two miles at 7.40 a. m., corrected for known anemometer error, becomes 132 miles per hour. Using Eiffel's value, .0033 SV^2 equals pounds per square foot, we find that the corresponding pressure is 57 pounds per square foot on a flat surface normal to the wind. Individual gusts no doubt exceed the average of two miles. The writer has examined some records from a Dine's pressure-tube anemometer in Washington which show that at extreme (one-mile) velocities between 40 and 50 the gusts were 30 per cent higher, but whether so great an increase occurred in the hurricane is unknown. If gusts exceeding by more than 30 per cent the record of the integrated miles had prevailed, we should expect less uniformity in the time for recording the single miles than the record shows. Few single miles differ greatly in length from adjacent miles.

The following table gives in miles for each hour the total movement, the maximum velocity for 5 minutes, and the extreme velocity, as indicated on the face of the record, and also the corrected values. The explanation of the use of 2 miles for the extreme at high velocities is found in the difficulty of measuring the record of a single mile.

Hour ending at	Total movement	Recorded		Corrected to true velocity	
		Maximum, 5-minute	Extreme	Maximum, 5-minute	Extreme
10 p. m.	31	36	[1] 38	35	[1] 37
11 p. m.	36	41	[1] 42	40	[1] 41
12 mdt.	40	46	[1] 52	44	[1] 50
1 a. m.	44	48	[1] 52	46	[1] 50
2 a. m.	51	59	[1] 60	57	[1] 58
3 a. m.	59	65	[1] 69	62	[1] 66
4 a. m.	77	88	[2] 104	84	[2] 100
5 a. m.	97	108	[2] 116	104	[2] 112
6 a. m.	104	108	[2] 122	104	[2] 117
7 a. m.	100	114	[2] 124	109	[2] 119
8 a. m.	114	128	[2] 138	123	[2] 132
8 to 8.12 a. m.	25	124	[2] 136	119	[2] 130

[1] Extreme from one mile of wind movement.
[2] Extreme from two adjacent miles.

No automatic record of wind direction was made, but the correspondence states that the direction at time of maximum was either east or southeast.

It seems appropriate to refer here to other records of high winds in the United States. The highest known, 186 miles per hour, was measured with a Robinson 4-cup anemometer on Mount Washington, N. H., at 4 a. m., January 11, 1878 (*2*). The possible error of the anemometer was even then recognized and mentioned in the published account. We now know that this value represents 140 miles true velocity. Some remarks of the observer on duty are as follows: "10th, 11.22 p. m.; east, 112 miles, heavy sleet (window stove in and storm shutters put up); 11.40 p. m., east, 144 miles, light snow; 12 midnight, east, 144 miles, heavy snow; 11th, 1 a. m., east, 150 miles, heavy snow (the roar of the wind is deafening and the building rocks and trembles); 2 a. m., east, 159 miles, heavy snow (another window stove in); 3 a. m., east, 168 miles, heavy snow; 4 a. m., northeast, 186 miles, heavy snow." The record does not state how long the anemometer was exposed between dial readings, but it is not likely to have been more than 5 minutes (the rule in vogue as shown by other journal entries) and may have been but one minute. There was no automatic record.

The Mount Washington record was made in connection with a storm that moved from Cape Hatteras up the Atlantic Coast, characterized as one of the severest ever known along the coast. "Innumerable wrecks occurred, notwithstanding every precaution had been taken."

At Cape Lookout, N. C., on August 18, 1879, a velocity of 138 was recorded, which corresponds to 105 miles per hour true velocity. Following the collapse of the anemometer the observer estimated the maximum at 165, which corresponds to 125 true velocity (*3*).

At Mobile, Ala., on October 18, 1916, an indicated 5-minute velocity of 115 was recorded, corresponding to a true velocity of 88 (*4*).

At Pensacola, Fla., on October 18, 1916, a 5-minute maximum of 114, true velocity 87, was recorded. Following the destruction of the anemometer, the estimated maximum was 120, true value 91 (*4*).

At North Head, Wash., on January 29, 1921, a maximum of 126, true value 96, was recorded. The fastest for one minute was 150, true value 114. Trees were

broken off where their diameter was as much as 4 feet. From examination of the age of trees destroyed, the observer concluded that this was the most destructive storm within 200 years (*5*).

The Miami Beach record therefore stands as the highest recorded by automatic instruments in the United States.

Engineers and others seeking to apply these velocities to structural problems will find information concerning the average pressure tending to overturn a model in Scientific Paper of the Bureau of Standards No. 523 (*6*).

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DESTRUCTIVE GUST AT JUPITER, FLA., FOLLOWING THE MIAMI HURRICANE

By H. B. BOYER, Meteorologist, In charge

[Weather Bureau office, Key West, Fla., October 4, 1926]

Attention is called to a freakish gust of wind of hurricane force that was experienced at Jupiter, Fla., on September 18, during the tropical storm of that date. This gust practically demolished the naval radio station at that place.

The gust that caused so much damage to the Jupiter radio station was unique in that its destructive force was confined to a narrow and well-defined path running from south-southeast to north-northwest with a width of about 400 feet.

A remarkable feature of this gust was that it occurred during a recrudescence of the storm and after the center had crossed the Florida Peninsula and was well off the west Florida coast.

Blowing with hurricane force from the northeast and east throughout most of Friday night, the wind veered to southeast and south on Saturday, gradually diminishing in velocity to a whole gale. This was in the natural order of events in a tropical storm whose center was moving on a westerly track to the southward of a given point. In all tropical hurricanes, within the area of hurricane winds, the most destructive are those that occur after the center has passed the gusts being of greatest violence and force, but diminishing in frequency and strength as the center recedes. At Jupiter there was a renewal of the storm to hurricane force during Saturday afternoon, the terrific gust that put the radio station out of commission occurring between 8 and 9 p. m. * * * In the area of great destruction one anchor of the 200-foot north tower containing 12 cubic feet of concrete was completely pulled out of the ground. Part of the roof of the dormitory was blown *southward* and deposited on the pier. This, in all probability, was done by an eddy, as there was no other evidence that the gust partook of the nature of a tornado.

E. C. Seibert, public works officer, communicates the following:

> It appears as though the majority of the damage at Jupiter was done in a very short space of time, 20 or 30 seconds, or even less. Shortly after 8 p. m., September 18th, a very sudden and marked increase in the wind velocity was noted by the personnel, and before the operator in the operating building could get out, the roof was off and the towers were down. No one witnessed the actual falling of the towers. From the manner in which brush and trees were knocked down, and from its effect on various structures, it appears that this sudden volume of wind was very narrow in width, perhaps only about 400 feet. It seems to have run just a few degrees west of north, wrecking the boathouse and carrying away the operating house roof, north and northeast towers, garage, etc. An old empty wooden tank on a comparatively light steel tower on the lighthouse reservation (to the east) was uninjured, although the tank, it is understood, is not fastened down to the top of the tower except by the effect of the riser pipe from the pump. This tank is only about 500 feet east of the operating building. In other words, the eastern extremity of this cyclonic gust seems to have been about 250 feet east of the operating house, while its western boundary was probably 150 feet. Also, the quarters on top the hill, to the east, and known as the old Weather Bureau House, was not materially damaged.

THE HURRICANE AT TURKS ISLAND, SEPTEMBER 16, 1926

By GEORGE GOODWIN

[Turks Island, West Indies]

At the 8 a. m. readings the weather had taken a very unfavorable change—barometer tending to fall and wind increasing and dropping every few minutes.

On receipt of advice from the bureau that the storm would pass over or near Turks Island, every available means was used to spread the information, that all necessary precautions might be taken. Since the barometer was falling rapidly a special observation was taken at 10:20 a. m. and all particulars sent to the bureau. Wind was then blowing at 36 m. p. h. from NW, with very heavy sea swell. Rain falling. At 1 p. m. the velocity of the wind had increased to 100 m. p. h. NW., with a very heavy sea swell, the intensity of the storm gradually increasing. A special observation was sent to the bureau. At this hour the office was flooded and the sea breaking over the top, carrying all before it. Huge blocks of cement weighing a ton being washed around as if mere pebbles. At 1:55 the storm had reached such intensity as to indicate that everything would be demolished. Wind then about 150 m. p. h., unroofing the office buildings, the roof of corrugated iron being carried about one mile inland. The sea swell at times was well above the window sills and before it could recede was caught by the next swell, the sea reaching inland for about three-quarters of a mile. The rain and sand at this time were blinding. The wind was so intense that the prickles from the prickly pear were blowing about like dust, being stripped off as the wind would strip a tree of its leaves.

At 5 p. m. it was deemed advisable to take shelter at the commissioner's residence. It took fully 40 minutes to cover a distance of less than a quarter of a mile; after a fierce fight we managed to reach our destination.

At 9:30 p. m., the storm having abated somewhat, the wind suddenly veered round to SE., still of a velocity of about 80 m. p. h.

The instruments of the bureau suffered badly. Cups of the anemometer were found half a mile away. The shelter with the thermometers was blowing around as if a sheet of paper. When eventually picked up it was

found to have sustained little damage and was easily repaired. I was unable to take readings until the 6th of October, unfortunately the clockwork of the barograph having got wet, and sand having found its way into the works of the anemometer register, the whole thing being wrecked. I was able to construct a makeshift from parts on hand * * *.

To illustrate the force of the water from the swell: A small boat of 14 feet * * * was hauled up in front of my residence situated on Front Street. This boat was carried over the abutment, over a 4 ft. 6 in. gate, round the yard, knocking down an outbuilding and finally coming to anchor by my carriage house. The sea rushed through my residence as if a river, at times being knee deep. Sand from the beach in the yard was above one's knees. The island even now is a perfect wreck and will take a large amount of money and time to put in any state of order * * *.

Date	Hour	Barometer	Wind	Sky	Sea
Sept. 15	----------	29.910	NE., 10 m.p.h.	Clear	
Sept. 16	8 a. m.	29.751	NW., 18	Cloudy	
	10:20 a. m.	29.630	NW., 36	Cloudy	Heavy swell.
	1:00 p. m.	29.265	NW., 100	Cloudy	Very heavy swell and intensity of storm increasing.

Measured precipitation 10 inches and rain still falling. Heavy swell carried rain gage some distance inland.

A. ÅNGSTRÖM ON "RADIATION AND CLIMATE"

By H. H. KIMBALL

[A review of *Geografiska Annaler*, 1925, H. 1, och. 2]

The paper deals principally with the heating effect of solar radiation received by the earth. It is based upon measurements made at or near Stockholm, Sweden, of the total radiation received on a horizontal surface directly from the sun and diffusely from the sky (Q), and the diffuse sky radiation alone (D); the net loss of heat due to the difference between the long-wave outward radiation from the surface of the earth and radiation of corresponding wave length to the earth from the atmosphere (R); the evaporation from the surface of the earth, and the reflection from snow surfaces.

From measurements of Q made since June, 1922, and records of the duration of sunshine, n, since 1908, the relation

$$Q_s = Q_o\ (0.25+0.75\ S) \qquad (1)$$

has been determined, where for a given day or a given month, Q_s is the average radiation receipt, Q_o the radiation that would have been received with a cloudless sky of average clearness, and $S=\frac{n}{N}$, where n is the number of hours of sunshine recorded by a modified Jordan photographic recorder, and N is the possible number of hours of sunshine.[1]

TABLE 1

	Monthly evaporation, mm.	Heat of evaporation	Reflection from snow surface	Outgoing radiation	3+4+5	Radiation income: Sun	Radiation income: D (sky)	Radiation income: Q (total)	9−6
January	7	420	420	3,570	4,410	180	670	850	−3,560
February	8	480	1,210	3,600	5,290	787	1,723	2,510	−2,780
March	15	900	2,030	3,900	6,830	2,640	1,870	4,510	−2,320
April	28	1,680	1,250	4,320	7,250	5,600	3,250	8,850	+1,600
May	47	2,820	-------	4,950	7,770	9,420	3,035	12,455	+4,685
June	67	4,020	-------	4,900	8,920	9,350	2,820	12,170	+3,250
July	73	4,380	-------	4,470	8,850	8,520	3,040	11,560	+2,710
August	61	3,660	-------	4,050	7,710	5,900	3,250	9,150	+1,440
September	40	2,400	-------	4,110	6,510	3,640	2,750	6,390	−120
October	23	1,380	120	3,510	5,010	1,166	1,800	2,970	−2,040
November	13	780	200	3,420	4,400	226	1,000	1,230	−3,170
December	8	480	270	2,940	3,690	47	690	740	−2,950
1	2	3	4	5	6	7	8	9	10

The values in columns 3 to 10, inclusive, are expressed in gram-calories per square centimeter of horizontal surface.

The measured values of (Q) and (D) for Stockholm have been smoothed by equation (1), and the monthly mean results are reproduced here in Table 1 under "Radiation income."

In the same way it is shown that the average outgoing radiation R_m may be determined with reasonable accuracy from the equation

$$R_m = R_o\ (0.25+0.75S) \qquad (2)$$

where R_o is the loss with a clear sky and S has the same significance as in equation (1).

The monthly mean values of R_m for Stockholm are given in Table 1 under the heading "Outgoing radiation."

The author shows that Q_o, Q_s ($=Q_m$ for monthly values), and R_m may be represented by Fourier series as in Table 2.

TABLE 2.—*Values of constants in formula*

$$A+a_1 \sin (\phi+x)+a_2 \sin (\phi_2+2x)+a_3 (\phi_3+\sin 3x)$$

	A	a_1	ϕ_1	a_2	ϕ_2	a_3	ϕ_3
			°		°		°
Q_o	10,780	9,050	295.1	295	164.5	440	154
Q_m	6,100	6,130	296.5	590	170.2	440	109
R_m	3,980	780	305.2	90	206.5	-------	-------
Q_m-R_m	2,120	5,380	295.5	520	164.3	-------	-------
W	−270	3,740	295.2	800	185.2	-------	-------

The values of Q, R, and W are given in gr. cal. per cm.²; $x=0°$ and 360° on January 15.

The quantity Q_m-R_m is designated by the author the "heat effective net radiation." Its monthly mean values may be found by subtracting values in column 5, Table 1, from values in column 9. The resulting values of Q_m-R_m may be represented by a series, the constants of which are given in Table 2.

If we deduct from Q_m-R_m the heat lost through evaporation from the surface of the earth and through reflection from the snow-covered surface, the monthly means of which are given in columns 3 and 4, Table 1, we obtain the "temperature effective energy," or W, the monthly mean values of which are given in the last column of Table 1. The constants of the Fourier series for W also are given in Table 2.

The author's discussion of Table 2 follows:

The table is instructive in many respects. It shows that the amplitude[2] of the second term, the whole-year term, as regards the total incoming radiation from sun and sky under the condition

[1] The equation obtained by the reviewer from monthly mean values of Q recorded by the Callendar recording pyrheliometer and of s recorded by the Marvin sunshine recorder is $Q_s = Q_o\ (0.22+0.78S)$. See Monthly Weather Review, 47:780, Figure 9, November, 1919.

[2] Amplitude here and in the following is equal to a_1, a_2, a_3 * * * and consequently equal to half the difference between maximum and minimum values.

of constantly clear weather, reaches a value of 9,050 gram calories, the monthly average being almost 10,800 calories. Through the influence of cloudiness the amplitude of the second term is reduced to 6,130 calories and the monthly mean value to 6,100 calories. When energy and not illumination is considered, we find these values to decrease to respectively 5,380 and 2,120 on account of losses of heat through the outgoing dark radiation. But even these values represent extremes which are never reached. If we take into account also the heat-spending effect of evaporation, we find the yearly amplitude reduced to 3,740 calories and the monthly mean to a value which is slightly negative.

The phase angle of the whole-year term keeps, as regards the different energy quantities considered, a remarkably unchanged value, namely, 295.5°, the differences between this value in the various cases falling below the probable error, which is about ±1.5°. ***This means, as we have counted the time from January 15th as zero, that the maximum of the annual harmonic variation (at June 21) almost exactly coincides with the summer solstice, the minimum December 22 with the winter solstice.*** **This fact, brought out by observations and registrations, seems well worth emphasizing.**

The third term in the development is the mathematical expression of the fact that the radiation income is not symmetrical with respect to the solstices, but that on account of the variations in the transmission power of the atmosphere, it is larger in spring than in autumn. The semiannual variation has a maximum in the end of May or during the first 10 days of June, another maximum in the beginning of December. Its minimum occurs in the end of August and in the beginning of March.

Passing now to the principal object of the paper, namely, the relation between radiation and temperature, the author finds the monthly mean temperature of Stockholm expressed in degrees centigrade, to be as follows:

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
−3.1	−1.9	−0.7	3.8	9.0	13.9	16.8	15.2	11.0	6.4	1.7	−0.9	5.9

From these the following series is obtained:

$$\theta = 5.9 + 9.7 \sin(262.2° + x) + 1.0 \sin(90° + 2x) + 0.2 \sin(288.5° + 3x) \tag{3}$$

From the second term it is seen that the maximum and minimum phases occur 33 days later than the maximum and minimum of the *temperature effective energy*, *W*.

Certain fundamental assumptions are made as to the relation between radiation and temperature, as follows:

I. To a given constant transfer of energy, *W*, corresponds at a certain locality a certain final temperature T_w, to which the temperature approaches as near as we wish, provided that we wait a sufficient time.

II. The velocity with which the temperature θ changes is in every time moment proportional to the differences $(T_w - \theta)$. We consequently have

$$\frac{d\theta}{dt} = c(T_w - \theta) \tag{4}$$

where t is the time and c is a constant.

III. The change in T_w is related to a given change in W through a linear function

$$dT_w = k\,dW$$

which gives

$$T_w = T_o + kW \tag{5}$$

where T_o is the temperature which corresponds to $W = 0$, and k is a constant.

The author states that these three constants, c, k, and T_o are characteristic of the temperature climate of a place. It is probable that $k = dT_w/dW$ varies but little with locality. On the other hand, the value of

$$c = \frac{d\theta/dt}{T_w - \theta}$$

varies with place depending upon the distribution of land and sea, and the character of the ground surface. The value of c gives a clearly defined measure of the degree of continentality of a place. The greater the value of c the more quickly the temperature reaches the final state, T_w, and the smaller the difference in phase between variations in energy income and in temperature.

We may solve for T_o and k from the equation $\theta = T_w[d\theta/dt = 0]$, and equation (5).

For Stockholm we have at the summer maximum of temperature and the winter minimum, respectively

$$\begin{aligned} 16.9° &= T_o + 2{,}700k \\ -3.1° &= T_o - 3{,}250k \\ \hline 20.0° &= \quad\;\; 5{,}950k \quad k = 0.00336, \text{ and } T_o = 7°.8 \end{aligned}$$

For variations in the value of θ with time the author gives the equation

$$\theta = T_m + M \sin \frac{2\pi t}{p} \tag{6}$$

where T_m = the annual mean temperature, M = the temperature amplitude, t = time, and p = time of a complete cycle. From the above

$$\frac{d\theta}{dt} = M \frac{2\pi}{p} \cos \frac{2\pi t}{p}$$

By substitution

$$\begin{aligned} W &= \frac{T_m - T_o}{k} + M\left(1/k \sin \frac{2\pi t}{p} + \frac{2\pi}{kcp} \cos \frac{2\pi t}{p}\right) \\ &= \frac{T_m - T_o}{k} + M\gamma \sin\left(\frac{2\pi t}{p} + \phi\right) \end{aligned} \tag{7}$$

when $\tan \phi = \frac{2\pi}{pc}$ and $\gamma = \frac{\sec \phi}{k}$.

For Stockholm ϕ = difference in phase between W and θ, = 33°, and γ = factor to reduce temperature amplitude to *temperature effective energy* amplitude, = 3740/9.7 = 386. Therefore, $c = 0.80$ and $k = 0.0031$, instead of 0.00336, as computed from equation (5).

The value of c varies inversely with the value of $\tan \phi$, as is illustrated by the values in Table 3, which gives values of c corresponding to different values of ϕ, and temperature amplitudes corresponding to the computed values of c and different amplitudes of *temperature effective energy*.

TABLE 3

$k = 0.0031$								
ϕ	days	c	Energy amplitude (gram calories per month)					
			1,000	2,000	3,740	6,000	8,000	
0°	0	--------	3°.1	6°.2	11°.5	18°.5	24°.8	Temperature amplitude.
15°	15	1.93	3°.0	6°.0	11°.2	18°.0	24°.0	
33°	30.5	0.80	2°.6	5°.2	9°.7	15°.6	20°.8	
45°	46	0.52	2°.2	4°.4	8°.2	13°.2	17°.6	
60°	61	0.36	1°.6	3°.1	5°.8	9°.3	12°.4	
75°	77	0.14	0°.8	1°.6	3°.0	4°.8	6°.4	

The table shows that a decrease in ϕ below 33° does not greatly increase the temperature amplitude—from 9.7° to 11.5° at Stockholm, for instance—while an increase in ϕ greatly reduces the temperature amplitude—

at Stockholm, from 9.7° to 3.0°. Therefore, to account for temperature amplitudes of 20° or more, which are common in continental climates in temperate zones, there must be increased amplitude in *temperature effective energy*. Table 1 indicates that this may be brought about through a decrease in cloudiness and in surface evaporation, both of which conditions commonly are characteristic of continental climates.

Under "Applications" the effects of variations in the average amount and the annual distribution of cloudiness are discussed. Since such variation would affect the evaporation and also the reflection from snow surfaces, the equation for $Q_m - R_m$, the *heat* effective net radiation is considered in connection with the equation for θ. In this case $d\theta/dt = c(T_w - \theta)$ as before; but $T_w = T_o + kQ$.

From the values of θ and Q at times of maximum and minimum values of θ the values of k and γ are found to be 0.0022 and 555, respectively.

The annual average percentage of possible sunshine for Stockholm is 39. Assuming this to be uniform throughout the year we obtain a Fourier series for θ_c which gives an annual temperature 1.2° lower and an amplitude 1.1° less than the series for θ. Assuming the skies to be cloudless throughout the year the series for θ_o is obtained, which gives an annual temperature 1.8° higher and an amplitude 6.3° greater than the observed.

The influence of variations in the value of the solar constant with the 11-year sunspot period is also considered, and it is shown that a solar-constant variation of 3.0 per cent over this period would cause the temperature to be 0.4° higher at sunspot maximum than at sunspot minimum, provided the variations in solar intensity did not cause variations in atmospheric transmissibility. As a matter of fact there are indications of increased cloudiness at sunspot maximum, especially at the cirrus level, so that actually the mean temperatures are a little lower at maximum than at minimum of solar spottedness. For this and other reasons the effect of solar variability upon earth temperatures is not clearly apparent.

It is pointed out that considerations quite similar to those here applied to annual variations of radiation and temperature, are applicable to semiannual and daily variations, with, however, a probable change in the value of the constants.

The results obtained seem to the reviewer to indicate that changes taking place within the atmosphere are capable of producing greater temperature variations, and therefore greater weather changes, than can be brought about by solar constant variations of the order of magnitude that are indicated by researches that have been published up to this time.

BROADCASTING WEATHER MAPS BY RADIO

By B. FRANCIS DASHIELL

[Forecast Division, Weather Bureau, Washington, D. C.]

It is a long step from the first broadcasting of a brief coded weather bulletin issued by the United States Weather Bureau from the Naval radio station NAA, at Arlington, Va., on July 13, 1913, to the transmission, through the same station, of the first complete radio weather-map picture on August 18, 1926.

Arlington's weather bulletins are familiar to nearly all radio operators and navigators. It was most fitting, therefore, that the opening of this new era in the dissemination of weather information should be done through the same station that made the original weather broadcasts in 1913.

The possibility of using radio for transmitting weather maps by the system to be described in this note is based on the fact that C. Francis Jenkins, its inventor, had already transmitted pictures, writing, etc., by his "Television" method. This method appeared to hold great possibilities for the Weather Bureau. If pictures could be sent, why not weather maps? Acting on this idea, E. B. Calvert, chief of the Forecast Division of the Bureau, suggested a conference, at which Mr. Jenkins's invention was inspected and its possibilities as a transmitter of weather maps discussed. The ultimate result of this conference was that, on August 18, 1926, the Navy Department cooperating, a special weather map was taken to the Arlington Radio Station, whence it was radioed to the Weather Bureau with remarkably good reproduction. (See Figure 1.)

In order that extensive tests might be conducted, the Navy Department not only generously loaned the services of its most powerful transmitter at Arlington, operating on 8,300 meters and using from 20 to 40 kilowatts, but it also conducted reception tests aboard U. S. S. *Kittery* and U. S. S. *Trenton* at sea.

The first transmission, on August 18th, was so satisfactory that on August 23d the Chief of Bureau invited members of the press and interested Government officials to a demonstration. Naval officials commented on the value that such a device would be to navigation, and the press of the country carried descriptions of the apparatus.

The tests of radio vision apparatus for broadcasting daily weather maps to ships at sea, as well as to others interested, though still in the experimental stage, show that such broadcasting is sound in theory and has considerable promise of being entirely practicable. But little is known as to the effectiveness of operation over considerable distances and during unfavorable conditions, such as static, wave-length interference, fading, the rolling of vessels, etc. These potential sources of trouble are being gradually investigated. Reception by the *Trenton* and *Kittery* was not entirely satisfactory, due to static and the rolling of the vessels, but maps were received by the *Kittery* as far south as Guantanamo Bay, Cuba. It is hoped that more tests can be conducted under seagoing conditions as improvements in radio and in the mechanical part of the transmission are made from time to time.

The Weather Bureau's experience, as well as that of the observers aboard the naval vessels, is that a map can be received through much static without destroying its value. All static impulses passing through the radio set are recorded as marks of various lengths on the map. This static would seriously interfere with ear reception of coded bulletins and, in many cases, may prevent the obtaining of sufficient data to prepare a map at sea. One map was received at the Weather Bureau during a heavy thunderstorm but the isobars and other data were quite legible. Incidentally, the recording of static impulses by this machine show some interesting actions of the electric waves that are propagated by lightning discharges.

In order to conduct still further tests under other conditions a 45-meter short-wave transmitter of the Jenkins Laboratories at Washington is also used. A

short-wave receiver has been built at the Weather Bureau and will soon be in use. The use of the short-wave sets will enable such tests to be carried on whenever desired and without restriction. Experiments are being carried on between Washington and Chicago using both short and long-wave transmissions. Further experiments will be conducted at the central office to determine the ability to register isobars and weather data on printed base maps instead of transmitting an entire map for reception upon plain paper. It is also hoped to speed up the time of reception from 50 minutes to approximately 15 minutes.

Since the first weather map was transmitted in August, several changes have been made in the machine design, to better adapt it to weather-map transmission. Daily tests of reception have shown marked improvement and maps of good quality are now being received. However, as reception conditions are well above the average in this case—the distance between Arlington and the Weather Bureau Office being but a few miles—we must await the results of the not yet thoroughly tested distant transmission, Arlington to Chicago, before we can know the performance of the machines under long-distance conditions.

A description of the operation of the Jenkins system in transmitting the weather map will be of interest. A map is drawn in black ink on a special base. (See Figure 2.) A photographic negative is then made of it, by direct contact printing. This is taken at once to the broadcasting station and placed in the transmitting machine.

The transmitter consists, in brief, of a glass cylinder, about which is wrapped the photographic negative. The cylinder is revolved at a constant speed by an electric motor. Within the cylinder is a small but powerful electric light. Outside of the cylinder is a light-sensitive photo-electric cell which is arranged so as to move along in front of the length of the cylinder at the rate of one-fiftieth of an inch for one complete revolution of the cylinder. This cell has a very small aperture and the light from within the glass cylinder passes through and affects the sensitivity and electrical conductivity of the cell. The electric light within the cylinder advances with the cell so as to be always opposite the aperture.

As the black and white portions of the film (the whites being transparent and the darks opaque) rotate before the aperture of the cell, the light passing through from within is intermittently cut on and off and the conductivity of the cell is varied accordingly. But as the cell is advancing along the cylinder from one end to the other at the rate of one-fiftieth of an inch to each revolution and the diameter of the aperture is the same, it will be seen that the same transparent place on the film never passes before the cell opening more than once. As the light is broken up into impulses of various durations by the white lines of the film, it causes corresponding variations in the electrical resistance of the cell. These resistance changes cause sharp fluctuations in the flow of current through the cell.

In order that this very weak current may be strengthened so that it will operate the relays of the powerful radio set, it must be passed through a number of alternating current transformers and amplifying electron tubes. A pulsating direct current through the cell is obtained by breaking up the light waves by means of a chopper wheel rotating in front of the electric light within the cylinder. This pulsating current can be transformed into alternating current so as to pass through any number of amplifying units necessary. The signals sent out by the radio station are similar to code signals except that they are a meaningless jumble of dots and dashes which are confusing to the uninitiated radio operator.

These may be received by any type of radio set capable of tuning to the wave lengths used and, after being suitably amplified, are passed to the map reproducer. A sheet of white paper is wrapped about a rotating cylinder of the same size as the one on the transmitter. Both cylinders operate as nearly as possible at the same speed and, as the radio impulses come in, a magnetic pen traces lines on the rotating paper to correspond with the transparent whites of the negative. The pen advances at the same rate as the electric cell before the rotating cylinder and the map picture is reproduced by a large number of fine lines marked in their proper positions and drawn in a very flat spiral around the paper on the cylinder. (See Figure 3.)

If the speeds of the two machines differ, the picture will be more or less distorted. Constant and equal speed of both machines is mechanically impracticable; hence it has been found necessary to synchronize the cylinders at each revolution. A special synchronizing master signal is transmitted at the end of each revolution of the sending machine, to hold the receiving cylinder from revolving until the end of this signal comes. In this way each new revolution begins in synchronism with that of the transmitter. The hesitation at the end of each revolution is very slight, but it is sufficient to keep any number of receiving machines in perfect step with the transmitting machine.

A photographic recorder is not used as such a machine is complicated and requires the use of dark rooms, careful handling of sensitive films, and the development and printing of the completed picture, all of which consume valuable time. The receiver now used instantly reproduces with ink and, when the last signal impulse is recorded, the map is complete.

HORIZONTAL GROUND DAY VISIBILITY AT ELLENDALE, N. DAK.

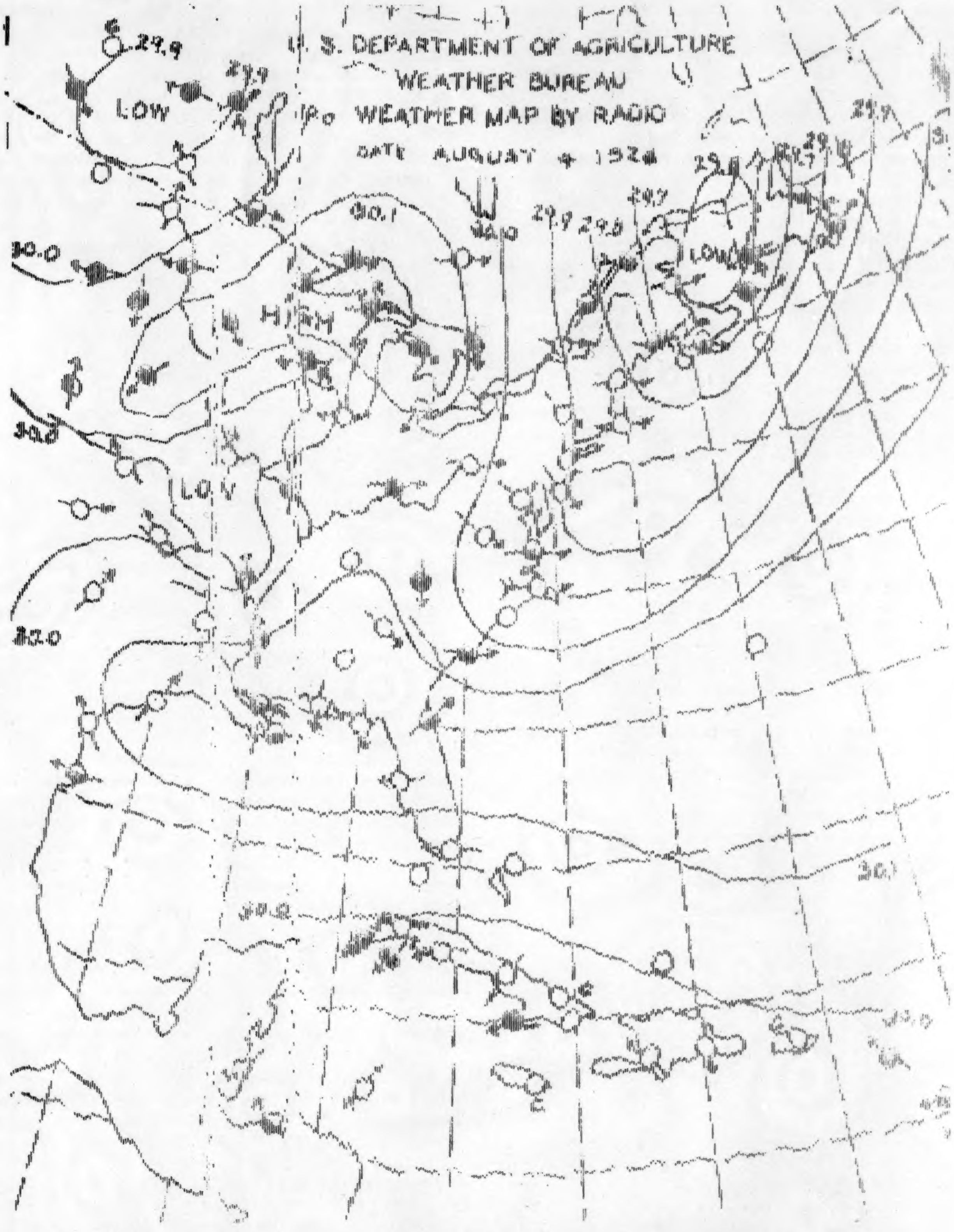
By LESLIE A. WARREN

[Weather Bureau Office, Ellendale, N. Dak.]

This paper is based on one year's observations at Ellendale, July 1, 1925, to June 30, 1926. Observations were made five and six times daily, at sunrise, 7 a. m., 10 a. m., 12:30 p. m., 3 p. m., 5:30 p. m., 8 p. m., and sunset. The sunrise, 7 a. m., 5:30 p. m., 8 p. m., and sunset observations were taken during part of the year only and not during the remainder, depending upon the time of sunrise and sunset. In addition to the record of visibility, certain other meteorological elements seeming to have more or less direct influence or effect on visibility were observed and recorded.

This paper confines itself principally to tabulating visibility frequencies and percentages of occurrence as they relate to the several other meteorological elements.

Unfortunately the topography about Ellendale is such that from our observation field east of town the only direction in which objects at greater distances than 9,000 meters can be seen is toward the southeast. The view



First experimental weather map transmitted from radio station Arlington, Va. and received at Weather Bureau Office, Washington, D.C. on August 18, 1926
E B Calvert

Fig. 1.

(To face p. 421)

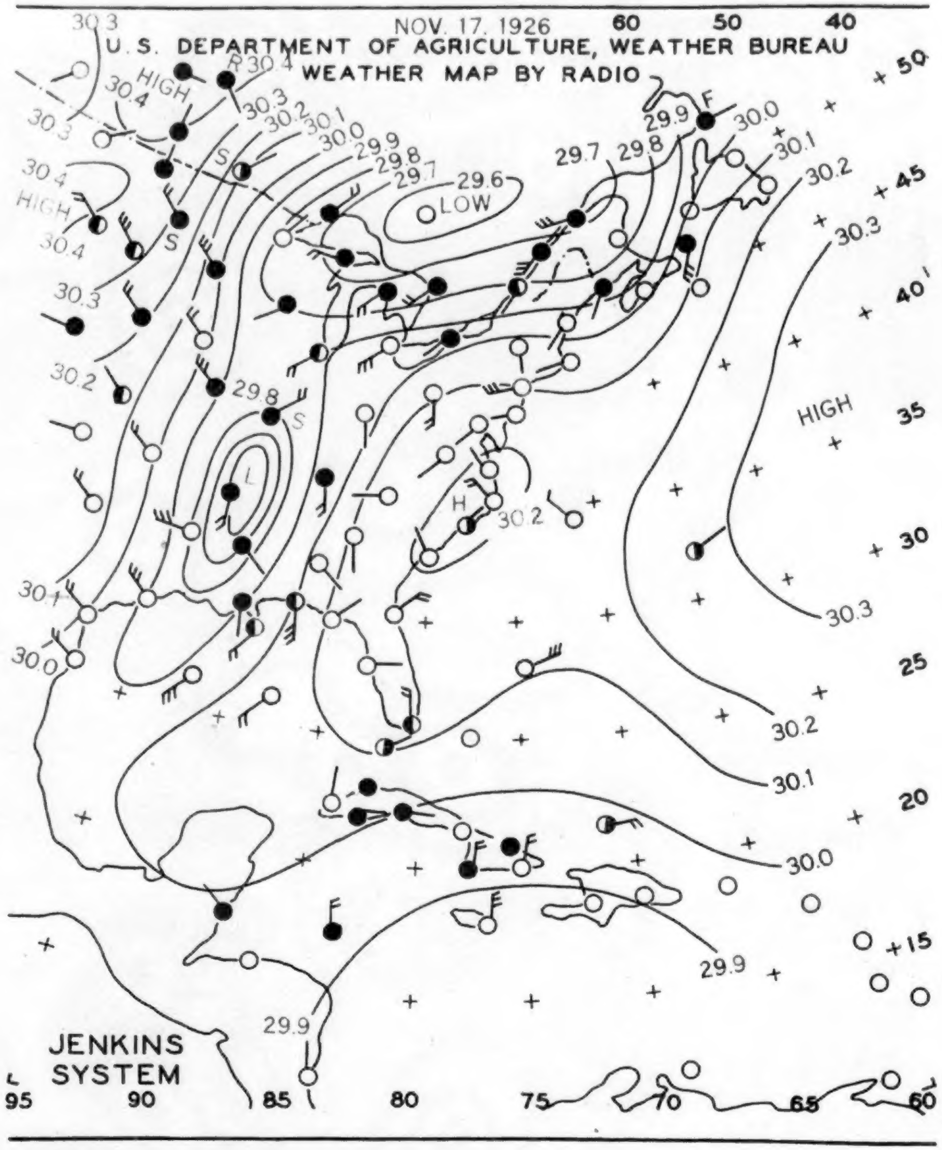


Fig. 2.—Special weather map of November 17, 1926, from which photographic negative was made for radio transmission

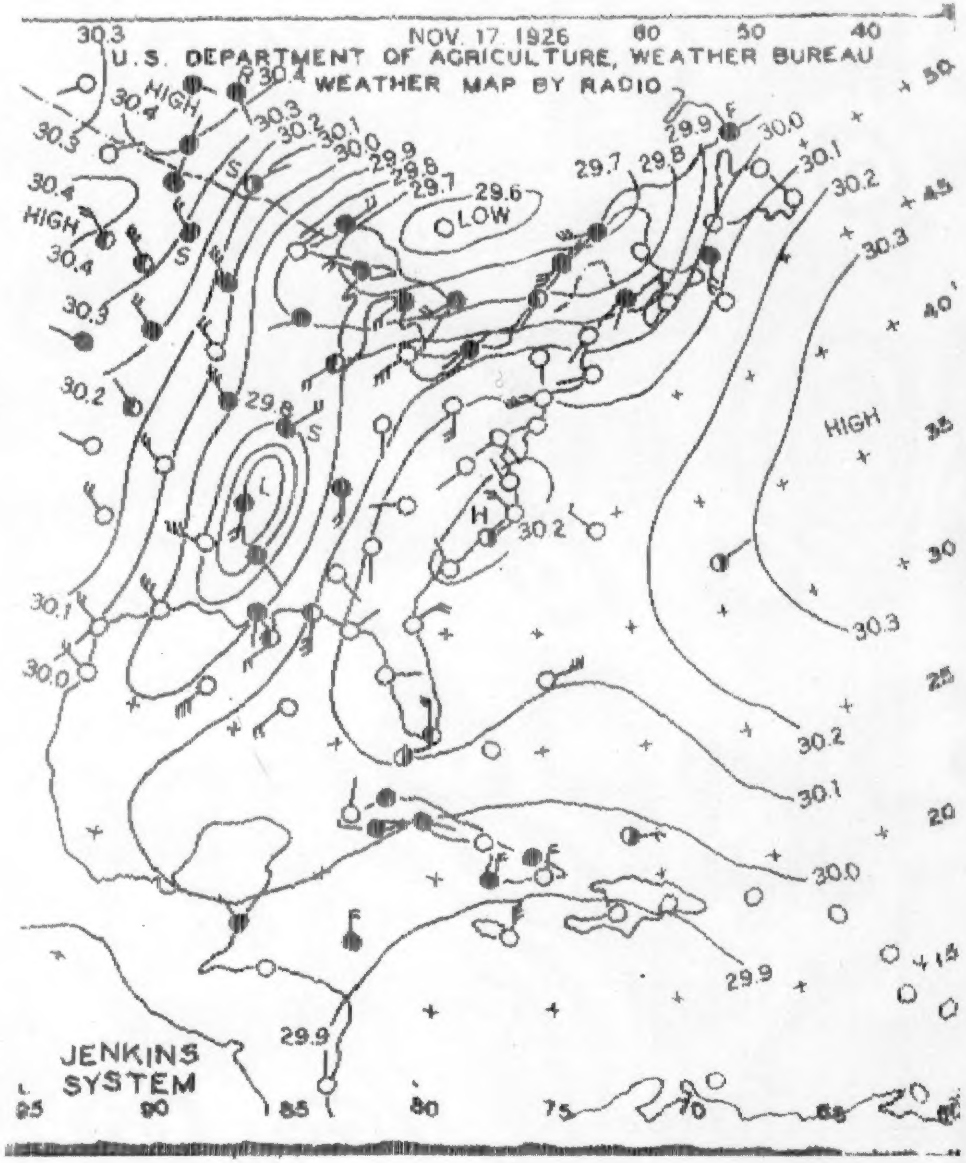


Fig. 3.—Map of November 17, 1926, as received at the Weather Bureau Office, Washington, from Station NAA, Arlington, Va.

in that direction is unbroken. From Ellendale a view toward both east and west is available, hence the evening observation was made in these directions, from the town. Determination of mean visibility is considered best when observations are made toward north and south, but these are impracticable in our case. However, we make no observations directly toward the sun.

The visibility scale in accordance with which these observations were made is the International Visibility Scale as it was before three recent changes were made in it, and during the period of the observations. For the purposes of this paper the old scale is quite satisfactory, and is given herewith.

International Visibility Scale

Descriptive term	Prominent objects not visible at—	
	Meters	Feet
Dense fog	50	160
Very bad	200	650
Bad	500	1,600
Very poor	1,000	3,300
Poor	2,000	6,600
Indifferent	4,000	13,100
Fair	7,000	23,000
Good	12,000	39,400
Very good	30,000	98,400
Excellent, prominent objects visible beyond	30,000	98,400

Table 1 summarizes the average seasonal and annual percentage frequencies of visibility for all the observations made during the year. Considering only those that were made daily throughout the year (10 a. m., 12:30 p. m., and 3 p. m.) as indicative of the daily averages, we find that autumn shows a greater frequency for the lesser visibilities, while summer shows a tendency toward better visibilities. The percentage frequency of visibility less than 7,000 meters is markedly lower for the afternoon observations than for those either morning or evening. Hence, we may assume that generally the best visibility occurs during the summer months and in the afternoon.

The percentage of occurrence of various visibilities according to surface wind direction is shown in Table 2. The greatest percentage of observations was made with NW. surface winds and the least with ESE. winds. Visibilities of less than 2,000 meters were not observed with either of these winds. The highest percentage of "very good" visibility occurred with west wind. On the whole it appears that we may expect better visibility with surface winds in the northwest quadrant, and poorer visibility with winds in the northeast.

Visibility frequencies with prevailing wind directions aloft through the first kilometer are given in Table 3. The greatest number of observations occurred with NNW. winds in this layer and the least with E. and ESE. winds prevailing. The best visibility may be expected with WNW. wind prevailing through this first kilometer and the poorest with ESE. wind.

Study of Table 4, in which visibility is compared with surface wind of velocity greater than and less than 5.4 m. p. s., shows that the frequencies of the better visibilities are nearly alike for both classes of wind velocity. The lesser visibilities seem more likely to occur with light surface winds than with strong.

Whether or not the sun is obscured by clouds apparently has but little effect on horizontal visibility; therefore this subject will not be discussed here.

We shall now consider visibility in connection with the meteorological elements of more vital concern to air navigation. The safety of flying varies considerably with the variations of low cloud, fog, and precipitation.

The existence of low clouds between 500 meters and 2,000 meters altitude appears to have no bad effect on visibility; but fog and, under certain conditions, cloud below 500 meters do affect visibility considerably. In Table 5, the first line shows what percentages of the grand total of observations were made when the sky was 0.5 or more clouded, for the different visibilities. The second line shows the percentages of occurrence of each visibility, in the observations made when the sky was covered 0.5 or more. We find that but 57 per cent of the cases indicate visibility less than 7,000 meters and but 22 per cent less than 4,000.

Table 6 shows visibility frequencies and percentages of occurrence with low clouds between 250 and 1,000 meters altitude. Only 100 observations were made under these conditions, out of a total of 730. Of cases of good visibility (12,000 m.), a very slightly higher percentage occurs in the afternoon, while the fair visibilities (7,000 m.) are considerably more frequent in the morning. No cases of less than 1,000 m. occurred in the afternoon, and but 3 in the morning.

In considering the visibility with clouds and fog lower than 250 meters, only the number of cases is given in Table 7. But 31 observations were made under these conditions. We find, of course, the best visibility with low clouds, the next best with light fog and the poorest with dense fog.

A few conclusions regarding other of the elements, for which tables have not been prepared, have been drawn from a study of the visibility record, as follows:

Days with thermal convection are more likely to give good visibility than those without. Convection is not, however, to be considered as an important determining factor in the causes of the better degrees of visibility.

On the whole it appears that we have fair or good visibility more often when we are under the influence of the eastern half of high pressure areas of the Alberta or North Pacific types than under any other pressure condition.

We find that better visibility occurs on days with low average relative humidity, except for the early morning observation; a number of good and very good visibilities were recorded with comparatively high humidity at the first morning observation.

TABLE 1.—*Average seasonal and annual frequency of visibility less than 12,000, 7,000, 4,000, 2,000, 1,000, 500, and 200 meters*

7 A. M.

Visibility less than—		Spring	Summer	Autumn	Winter	Annual
Meters	*Feet*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
200	650	0	1	5	0	2
500	1,600	0	3	5	0	2
1,000	3,300	0	3	5	8	4
2,000	6,600	0	4	5	17	6
4,000	13,100	5	12	15	17	12
7,000	23,000	37	47	59	58	50
12,000	39,400	89	91	100	100	95

SUNRISE

200	650	----------	----------	2	3	2
500	1,600	----------	----------	8	4	6
1,000	3,300	----------	----------	10	9	10
2,000	6,600	----------	----------	16	14	15
4,000	13,100	----------	----------	16	22	19
7,000	23,000	----------	----------	76	73	74
12,000	39,400	----------	----------	100	100	100

TABLE 1.—*Average seasonal and annual frequency of visibility less than 12,000, 7,000, 4,000, 2,000 1,000, 500, and 200 meters*—Con.

10 A. M.

Visibility less than—		Spring	Summer	Autumn	Winter	Annual
Meters	*Feet*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
200	650	0	0	1	0	[1]0
500	1,600	0	0	3	0	1
1,000	3,300	0	0	4	6	2
2,000	6,600	1	2	14	8	6
4,000	13,100	10	8	22	16	14
7,000	23,000	33	36	46	52	42
12,000	39,400	93	100	95	99	97

12:30 P. M.

200	650	0	0	0	0	0
500	1,600	0	0	0	0	0
1,000	3,300	0	0	2	1	1
2,000	6,600	0	0	7	4	3
4,000	13,100	5	4	9	12	8
7,000	23,000	29	30	26	36	30
12,000	39,400	93	99	90	91	93

3 P. M.

200	650	0	0	0	0	0
500	1,600	0	0	0	0	0
1,000	3,300	0	0	0	1	[1]0
2,000	6,600	2	0	4	6	3
4,000	13,100	8	4	9	7	7
7,000	23,000	29	23	31	26	27
12,000	39,400	82	78	77	71	77

[1] Less than 0.5 per cent.

TABLE 1.—*Average seasonal and annual frequency of visibility less than 12,000, 7,000, 4,000, 2,000, 1,000, 500, and 200 meters*—Con.

5:30 P. M.

Visibility less than—		Spring	Summer	Autumn	Winter	Annual
Meters	*Feet*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
200	650	0	0	0	----------	0
500	1,600	0	0	2	----------	1
1,000	3,300	0	0	5	----------	2
2,000	6,600	0	0	7	----------	2
4,000	13,100	7	4	7	----------	6
7,000	23,000	31	24	23	----------	26
12,000	39,400	86	95	84	----------	88

SUNSET

200	650	0	0	0	0	0
500	1,600	0	0	0	0	0
1,000	3,300	0	0	0	0	0
2,000	6,600	0	0	0	0	0
4,000	13,100	6	7	6	7	6
7,000	23,000	29	62	32	40	41
12,000	39,400	93	100	100	96	97

8 P. M.

200	650	0	0	----------	----------	0
500	1,600	0	0	----------	----------	0
1,000	3,300	0	0	----------	----------	0
2,000	6,600	0	0	----------	----------	0
4,000	13,100	0	2	----------	----------	1
7,000	23,000	10	40	----------	----------	25
12,000	39,400	90	98	----------	----------	94

TABLE 2.—*Visibility with surface wind direction*

Surface wind direction			N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.
			Percentage of occurrence															
Observations with visibility	Meters	Feet	11	5	8	3	2+	2−	5	3	11	5	6	3	5	5	17	10
Very bad	200	650	0	0	0	0	0	0	0	0	[1]0	1	1	2	0	0	.6	0
Bad	500	1,600	.5	0	1	0	2	0	0	0	1	4	0	2	0	0	0	0
Very poor	1,000	3,300	1	1	2	2	4	0	0	0	1	4	1	0	0	0	1	0
Poor	2,000	6,600	3	3	4	2	2	0	2	2	3	0	2	0	1	0	2	3
Indifferent	4,000	13,100	3	6	5	6	4	3	8	9	8	10	4	2	0	5	3	6
Fair	7,000	23,000	23	28	31	36	38	30	42	31	40	29	17	17	25	24	22	25
Good	12,000	39,400	62	53	50	52	46	61	44	51	44	46	67	62	55	59	62	53
Very good	30,000	98,400	8	9	8	2	6	6	4	6	3	7	9	15	18	12	11	13

[1] Less than 0 5%.

NOTE.—The extremes under "Poor" to "Very good" visibility are printed in boldface type.

TABLE 3.—*Visibility frequencies with prevailing wind direction, aloft through first kilometer*

Visibility less than—		N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.
		Per cent															
Meters	*Feet*																
200	650	0	0	0	0	0	0	0	0	0	0	0	4	0	0	1	0
500	1,600	0	0	0	0	0	7	0	0	2	0	0	4	0	0	1	0
1,000	3,300	0	3	0	0	7	7	0	0	4	2	2	4	0	0	1	0
2,000	6,600	1	9	0	4	13	7	6	11	6	2	5	4	0	0	2	2
4,000	13,100	4	9	8	7	20	13	12	28	14	8	5	4	3	4	3	5
7,000	23,000	37	41	25	37	40	60	53	44	55	42	45	42	22	34	30	37
12,000	39,400	86	85	88	93	93	93	94	95	98	82	91	77	77	77	85	82
Total number of observations with		91	34	24	27	15	15	17	18	49	50	44	26	37	47	87	97

TABLE 4.—*Visibility with surface wind velocity*

Visibility	5.4 m. p. s. and less: Less than—	5.4 m. p. s. and less: Percentage frequency	5.4 m. p. s. and less: Per cent of occurrence	More than 5.4 m. p. s.: Percentage frequency	More than 5.4 m. p. s.: Per cent of occurrence
	Miles				
Very bad	200	1	1	[1] 0	[1] 0
Bad	500	2	1	[1] 0	[1] 0
Very poor	1,000	3	1	1	1
Poor	2,000	5	2	4	3
Indifferent	4,000	9	4	10	6
Fair	7,000	37	28	37	27
Good	12,000	92	55	91	54
Very good	30,000	100	9	100	9
No. of observations, 913				No. of observations, 1,074	

[1] Less than 0.5 per cent.

TABLE 5.—*Visibility with 0.5 or more of sky obscured by low clouds*

	Visibility: Very bad	Bad	Very poor	Poor	Indifferent	Fair	Good	Very good
Less than (meters)	200	500	1,000	2,000	4,000	7,000	12,000	30,000
Per cent of occurrence	1	2	3	6	10	35	38	5
Percentage frequency	1	3	6	12	22	57	95	100

TABLE 6.—*Visibility with low clouds between 250 m. and 1,000 m. altitude*

[From a total of 730 observations]

Visibility less than—: Meters	Feet	A. M.: Number of observations	A. M.: Percentage frequency	P. M.: Number of observations	P. M.: Percentage frequency
200	650	0	0	0	0
500	1,600	1	2	0	0
1,000	3,300	2	5	0	0
2,000	6,600	3	16	4	9
4,000	13,100	7	24	7	25
7,000	23,000	31	80	17	62
12,000	39,400	9	96	17	100
30,000	98,400	2	100	0	100

TABLE 7.—*Visibility with clouds and fog lower than 250 m.*

Visibility	Meters	Feet	A. M. Number of observations with—: Light fog	Dense fog	Low clouds	P. M. Number of observations with—: Light fog	Dense fog	Low clouds
Very bad	200	650	0	3	0	0	0	0
Bad	500	1,600	0	5	0	0	0	0
Very poor	1,000	3,300	3	0	0	2	0	2
Poor	2,000	6,600	2	0	1	1	0	0
Indifferent	4,000	13,100	0	0	6	0	0	0
Fair	7,000	23,000	0	0	5	0	0	1
Good	12,000	39,400	0	0	0	0	0	0

A GRAPHIC AND TABULAR AID TO INTERPRETING CORRELATION COEFFICIENTS

By J. F. VOORHEES

[Weather Bureau, Washington, D. C.]

A graph and a table are presented herewith, which have been found helpful in correlation studies, because through the use of either of them one may see at a glance what a given value for r is worth for forecasting purposes (*1*).

Suppose we have the value $r = \pm.60$ for a given set of data. Applying the formula $y' = bx - a$, where x is the independent variable, and where $b = \frac{n(\Sigma Xy) - (\Sigma X)(\Sigma y)}{n(\Sigma X^2) - (\Sigma X)^2}$ and $a = \frac{\Sigma y - b\Sigma X}{n}$, (*2*) we obtain the values that y would have if x were the only independent variable. If we now compute the σ of the residuals $(y-y')$ it will be

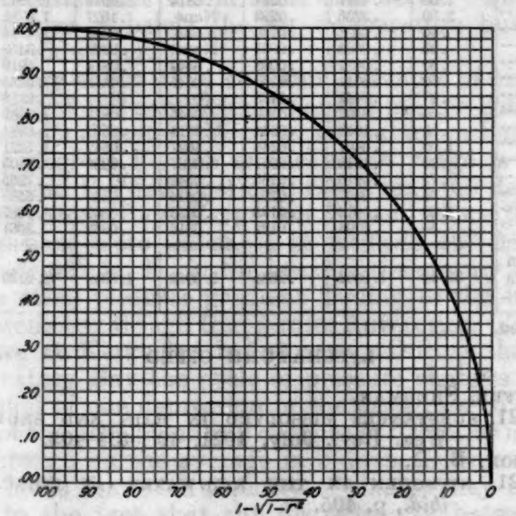


FIG. 1.—Showing value of $1-\sqrt{1-r^2}$, which equals the per cent by which the $\sigma\,(y-y')$ is less than σy, for values of r from 0 to 1

found to be 80% of the σ of y. That is, when $r = \pm.60$, $\frac{\sigma(y-y')}{\sigma y} = 80\%$ of the σ of y, or the $\sigma\,(y-y')$ is 20% less than the σy. But, $\frac{\sigma(y-y')}{\sigma y} = \sqrt{1-r^2}$, and

$$1 - \frac{\sigma(y-y')}{\sigma y} = 1 - 1\sqrt{1-r^2}. \quad (3)$$

Plotting the values of $1-\sqrt{1-r^2}$ against the values of r, we get the curve shown in the figure, which is an arc of a circle.

The table may be obtained from the graph or calculated by the formula, % reduction of $\sigma = 1-\sqrt{1-r^2}$, and represents the percentage by which the $\sigma\,(y-y')$ is less than the σy, for all values of r from 0 to 1.00.

TABLE 1.—*Value of $1-\sqrt{1-r^2}$, which equals the per cent by which $\sigma\,(y-y')$ is less than σy, for values of r from 0 to 1.*

r	$1-\sqrt{1-r^2}$	r	$1-\sqrt{1-r^2}$	r	$1-\sqrt{1-r^2}$	r	$1-\sqrt{1-r^2}$
100	100	75	34	50	13	25	3
99	86	74	33	49	13	24	3
98	80	73	32	48	12	23	3
97	76	72	31	47	12	22	2
96	72	71	30	46	11	21	2
95	69	70	29	45	11	20	2
94	66	69	28	44	10	19	2
93	63	68	27	43	10	18	2
92	61	67	26	42	9	17	2
91	59	66	25	41	9	16	1
90	56	65	24	40	8	15	1
89	55	64	23	39	8	14	1
88	53	63	22	38	8	13	1
87	51	62	22	37	7	12	1
86	49	61	21	36	7	11	1
85	47	60	20	35	6	10	1
84	46	59	20	34	6	9	0
83	45	58	19	33	6	8	0
82	43	57	18	32	5	7	0
81	41	56	17	31	5	6	0
80	40	55	16	30	5	5	0
79	39	54	16	29	4	4	0
78	38	53	15	28	4	3	0
77	36	52	15	27	4	2	0
76	35	51	14	26	3	1	0

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SUBSTANCES IN RAINS AND SNOWS

By HARRY RIBBLE and PAUL BOWMAN

[Cornell College, Mount Vernon, Iowa]

(Prepared under the supervision of Dr. Nicholas Knight, Department of Chemistry)

The fact that certain substances are dissolved in rain and snow has led to considerable work in the laboratories of a great many colleges and universities. This has had special attention at Cornell College for some years (*1*) and the following is a report of the quantitative analysis covering a period of the past two years.

Our special purpose is to determine the amounts of nitrogen compounds, chlorine, and sulfates in the rains and snows of this locality.

The work was carried on in a private laboratory free from the usual laboratory fumes, the samples were collected in enamelware pans near the center of the residence district of Mount Vernon, Iowa. There are no manufacturing industries within a radius of seventeen miles. Throughout the work every possible precaution was taken to avoid contamination. Samples were promptly collected and determinations were made as soon as possible thereafter.

Altogether 70 samples were analyzed of which 13 were snow. Twelve inches of snow were taken to equal one inch of rain. In order to determine the number of pounds of each substance that fell per acre, we took 226,000 pounds to be the weight of one inch of rain on an acre.

The precipation contains varying amounts of chlorine. Our theory regarding this is that since the precipitation seems to come from the East, the salt particles are probably carried from the Atlantic Ocean. The spray on the shore may be caught by the wind and borne across the continent, until it descends in solution with the rains and snows. The chlorine was determined with hundredth normal silver nitrate using neutral potassium chromate as the indicator.

The textbook followed in this work was "Quantitative Chemical Analysis" by Dr. N. Knight, with occasional reference to the "Report of Committee on Standard Methods of Water Analysis to the Laboratory Section of the American Public Health Association."

TABLE 1.—*Amounts of certain substances dissolved in rain and snow, as observed at Cornell College, Mount Vernon, Iowa*

Date	Precipitation	Nitrates	Nitrites	Free ammonia	Albuminoid ammonia	Sulfates	Chlorine
1924	*Inches*	*Lbs. per acre*	*Lbs. per acre*	*Lbs. per acre*	*Lbs. per acre*	*Lbs. per acre*	*Lbs. per acre*
Sept. 19	0.50	0.0407	0.0024	0.7345	0.3955	2.6292	1.203
Sept. 21	.15	.0061	Trace.	.2034	.1186	.8303	.409
Sept. 27	.20	.0285	None.	.1808	.1582	2.1864	.508
Oct. 4	.20	.0326	None.	.3616	.2034	3.7639	.642
Oct. 8	.50	.0916	.0102	.5085	.3955	8.1644	1.605
Oct. 30	.40	.1954	None.	.2712	.3616	3.9853	1.605
Nov. 6	.50	.2239	None.	.8475	.3390	6.3655	.802
Nov. 8	.20	.0651	.0007	.1582	.1808	1.5499	.963
Nov. 13	.30	.0733	.0005	.1695	.3955	1.2039	1.685
Dec. 5	1.10	.4925	.0045	1.1187	.6215	5.4798	1.765
Dec. 14	.33	.1746	None.	.3000	.3752	None.	1.588
Dec. 21	.50	.2035	.0061	.3955	.2825	1.1347	1.203

TABLE 1.—*Amounts of certain substances dissolved in rain and snow, as observed at Cornell College, Mount Vernon, Iowa*—Continued

Date	Precipitation	Nitrates	Nitrites	Free ammonia	Albuminoid ammonia	Sulfates	Chlorine
1925	*Inches*	*Lbs. per acre*	*Lbs. per acre*	*Lbs. per acre*	*Lbs. per acre*	*Lbs. per acre*	*Lbs. per acre*
Jan. 16	0.33	0.0541	0.0068	0.3005	0.3752	11.5271	0.794
Feb. 8	.23	.1489	.0011	.3005	.6780	5.0232	1.059
Feb. 16	.25	.0916	.0010	.3119	.1505	2.5254	.481
Feb. 20	.15	.0611	.0013	.3390	.3051	(1)	.334
Feb. 22	.10	None.	.0007	.0904	.2260	1.5083	.241
Mar. 1	.33	.0676	.0008	.5266	.3006	.3927	.422
Mar. 8	.13	.0635	.0013	.1175	.2644	2.2307	.271
Mar. 14	1.00	.2442	.0008	1.8080	.7910	2.8229	1.605
Mar. 18	.10	.0285	.0023	.4068	.1017	1.1347	.241
Apr. 9	.25	.0814	.0051	.6780	.1695	7.0403	.199
Apr. 16	.25	.3053	.0037	.2543	.1978	4.4282	.602
Apr. 23	1.25	.4070	.0061	1.4125	.8475	1.3492	2.006
Apr. 25	.25	.0611	.0006	.2825	.2260	6.0887	.482
Apr. 29	.65	.0794	.0011	.4972	.2938	22.3068	.834
May 3	.13	.1058	.0034	.1763	.1469	2.9503	.313
May 16	.50	.1221	.0004	.7345	.3390	7.3341	.802
May 16	.10	.0448	None.	None.	None.	(1)	.241
May 20	.12	.2442	.0033	.2170	.2305	4.6772	.193
June 1	.25	None.	.0051	.2543	.2260	.8649	.281
June 2	1.75	None.	.0035	1.3843	.9887	16.7440	2.808
June 3	2.00	.8140	.0016	.4520	.7684	27.3992	1.605
Total in pounds per acre	15.10	4.6524	.0744	15.7935	11.4539	165.6412	29.792
June 15	.50	.5698	.0004	.1266	.0283	.3459	.802
June 17	2.00	.0407	None.	.0181	.0615	5.2584	6.418
June 22	.90	.0366	None.	.0651	.0325	1.6191	2.882
June 24	.60	.1465	None.	.1844	.0325	2.0757	1.925
Sept. 20	.10	.0285	None.	.0081	(1)	.3459	.200
Sept. 30	4.50	.3663	None.	.5695	.1139	9.9634	10.881
Oct. 3	2.00	.0407	Trace.	.1446	.1085	4.4282	3.530
Oct. 5	.20	.1465	.0002	.0163	.0145	.3598	.321
Oct. 6	1.00	.1221	None.	.1085	.0181	2.7696	1.765
Oct. 8	.20	.0407	Trace.	.0163	.0018	.3875	.353
Oct. 11	.60	.0733	Trace.	.0488	.0325	2.4908	1.412
Oct. 12	.70	.1139	Trace.	.1130	.0633	1.8405	1.685
Oct. 25	.33	.0537	Trace.	.0542	.0004	.7749	.688
Oct. 27	.42	.0509	Trace.	.0339	.0105	.8137	.876
Nov. 4	.50	.1018	None.	.0149	.0181	.9687	.802
Nov. 7	.66	.0814	Trace.	.0118	.1627	.3681	1.230
Nov. 29	.50	.0407	Trace.	.0090	.0181	.2770	.802
Dec. 5	1.10	.0895	Trace.	.0895	.0597	1.8279	1.765
Dec. 15	.50	.0407	None.	.0226	.0045	1.4540	1.211
1926							
Jan. 4	.90	.6593	Trace.	.0163	.0692	4.2375	2.021
Jan. 12	4.00	.8140	Trace.	.1446	.0362	5.5392	9.627
Jan. 28	.33	.3907	Trace.	.0271	.0181	2.0107	.529
Feb. 18	1.00	.4477	.0244	.0814	.0248	2.3542	1.605
Feb. 25	2.00	.3256	.0293	None.	.1627	7.0781	5.767
Mar. 6	.40	.1628	.0130	None.	.0362	1.4945	2.952
Mar. 14	.25	.0305	.0055	None.	.0226	.3459	.883
Mar. 28	.50	.0611	.0098	.0542	.0814	.6919	1.043
Mar. 31	.50	.0611	.0103	.0045	.0814	.5535	1.284
Apr. 2	.27	.2442	.0488	(1)	(1)	.9216	5.776
Apr. 6	.50	.0407	.0109	.0045	.0813	1.7989	3.530
Apr. 18	.50	.1018	.0244	.0814	.0362	2.6984	1.364
Apr. 24	1.00	.0407	.0244	.1627	.0542	1.5221	2.888
May 2	.25	.1018	.0061	.0407	.0226	.3805	.569
May 13	.75	.0916	.0165	.0542	(1)	.7265	1.203
May 18	.50	.0407	.0122	.0814	.0542	.5535	.802
May 24	1.00	.0814	.0195	.0633	.0362	.9687	1.605
May 31	.50	.0204	.0122	.0316	.0362	.3681	.882
Total in pounds per acre	32.46	5.9004	.2685	2.5040	1.6349	72.6129	83.837

[1] Not tested.

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CLIMATE AND WEATHER AT KERGUELEN ISLAND

By BURTON M. VARNEY

Volume III, Part 3, of the results of the German South Polar Expedition of 1901–1903, is the subject of a review by Dr. Ludwig Meckling in Petermann's Mitteilungen, 1926, Heft 9/10. The meteorological results obtained at "Gauss Station" in the Antarctic have been presented and exhaustively discussed by Meinardus in preceding volumes. The *Gauss* on her way south left an observing party on Kerguelen, who, during a full year thereafter, obtained the observations now similarly treated by Meinardus. That many problems remain unsolvable because of shortness of the record, he clearly indicates; nevertheless, the *Gauss* observations make available for the first time a means for outlining the general characteristics of the year-round climate in this desperately storm-ridden part of the South Indian Ocean. The fact that such can be done with reasonable completeness on the basis of one year's data, supplemented by collateral evidence from the scattered records made by various agencies since Sir James Ross's pioneer observations in the winter of 1840, is, of course, because Kerguelen shares with oceanic islands in pleasanter latitudes the monotony of weather and climate induced by pure marine control.

But in Kerguelen's case, what a monotony! It is that of a climate so cold that snow may fall on any day in the year, though warm enough for the mean temperature of no month to be below freezing; so cold that frosts occur on 140 days annually, but so warm that the ground never freezes deeper than 5 cm.; cold enough to have the lowest temperature below freezing on 248 days annually, yet warm enough to have more rainy days than snowy. The seeming anomaly of frost occurrence only about six-tenths as often as the occurrence of a minimum air temperature below freezing, is ascribed by Meinardus to the fact that the permanently water-logged condition of the boggy ground which predominates throughout the island so reduces the diurnal oscillation of ground temperature as to prevent the formation of a large proportion of the frosts that would otherwise occur. The ground temperature is below the air temperature but a short time in midwinter.

The very slight daily and annual ranges of air temperature reflect the completeness of the marine control over Kerguelen's climate. With an annual mean temperature of 37.8 degrees F., the annual mean range is but 11.9 degrees and the daily periodic range only 3.8 degrees.

Observatory Bay, Kerguelen Island, where the Gauss observations were taken, is in latitude 49° 25′ S. and longitude 69° 54′ E., in the heart of the stormy westerlies on the steep pressure gradient leading to the bottom of the barometric trough that girdles Antarctica. The mean pressure at Kerguelen is 752 mm. During the year at Observatory Bay the cycle of pressure changes from the minimum of one depression in the barogram to the minimum of the next (counting changes of 5 mm. or more) was run through on the average in 2 days, 21 hours. Meinardus holds that such rapidity of change may be due, in part, to the fact that the discontinuity between polar waters and those under the westerlies, for this part of the world, lies near Kerguelen. At any rate the record at the island shows the greatest persistence of heavy winds of which we have any knowledge. One is not surprised that under such conditions the average wind velocity is 19.2 m. p. h., or that winds of gale force are recorded on one day out of four. This constancy of high winds stands in contrast to the alternation of gales and calms which is characteristic of points along the coast of Antarctica. But the storms of Kerguelen are less severe and last not so long as the Antarctic storms. The contrast in wind conditions is still further emphasized by the percentage frequencies of winds from different quadrants at Kerguelen and at "Gauss Station" in the Antarctic:

Quadrant	N.	E.	S.	W.	Calm.
Kerguelen	11	4	6	75	4
"Gauss Station"	1	65	11	12	11

Wind frequencies and velocities run parallel at Kerguelen, so that the westerlies are the heaviest winds. The approach of depressions from the west is heralded typically by violent NNW. squalls.

Of the prevailing northwesterlies and of the respites from them enjoyed by the inhabitants at the whaling station on this dreary outpost, the following extracts from the South Indian Ocean Pilot of the British Admiralty give a vivid impression:

> This wind is often deflected on the lee side by the steep valleys and fiords which intersect the island, usually taking the direction of a valley, which acts as a funnel, and descending in heavy gusts or whirlwinds, raises large sheets of foam. So violent are these gusts in Christmas Harbor that Sir James Ross was frequently obliged to throw himself on the ground to prevent being blown into the water; and vessels moored at the head of the harbor were sometimes laid over on their beam ends.
>
> M. Bossière says: "The wind at frequent intervals blows with great violence, but it is more terrifying than dangerous. It is an error to seek shelter at the foot of the mountains. The wind falls there like a veritable cascade and the sea is ground into powder."
>
> On the western or weather side of the island the air, saturated with moisture, impinging on the steep mountain ranges, causes frequent showers of snow, hail, or rain, and the clouds arrested by the hills accumulate and descend, causing mists and fogs; whilst, as is usually the case, on the leeward side the air is generally dry and there is but little fog.
>
> The prevailing westerly wind is sometimes interrupted by northeasterly and northerly winds, which blow with considerable force, and during their continuance the sky is overcast and the weather thick and rainy; they usually follow a high barometer and fine weather. Just before they commence the barometer falls rapidly and the thermometer rises, and their duration is inversely as the rate of descent of the barometer.
>
> Occasionally, but very rarely, the usually boisterous weather is interrupted by a calm or a light easterly wind, when the sky is perfectly free from cloud and the atmosphere is remarkably clear, every hill-top being distinctly visible; this seldom lasts 24 hours and is generally succeeded by a gale.

It will be inferred from the table of wind-direction frequencies given above and from the description following it, that Kerguelen lies not far from and north of a well-frequented track of depressions in that part of the world.

The rapidity with which cloudiness changes is in harmony with the rapid passage of pressure waves. To state that mean cloudiness at Kerguelen is 0.7 signifies little, for in this bleak land where not a single day in the year of the *Gauss* observations had cloudless skies at all three observation hours, nevertheless on only 106 days was a completely overcast sky observed and but 35 days had no sunshine whatever.

This means, literally, that the sun shone for at least a brief period on 330 days in the year; but how slight the cheer in a figure like that when, in addition to the wind and low temperature and high relative humidity, the

chance of precipitation is 80 per cent, the rainy spells average 8.3 days in length and the "dry" spells 1.9 days. It rarely rains hard, however. In giving the annual total of approximately 850 mm. (34 inches), about half the days had less than 1 mm., while the maximum 24-hour rainfall was but 42.6 mm. (1.70 inches). Precipitation, except for the very rare local showers, comes as a driving, chilling drizzle or as a gale-borne sleet and snow. The winter is characterized by frequent brief snowfalls, most of its precipitation being in this form. Spring is the snowiest season and October the snowiest month. More than half the days of the year have snow, but the landscape is snow covered on only a third of the days. In the words of Meinardus:

> The winter brings the greater total of precipitation, greater violence and frequency, but shorter duration; the summer brings less, more gentle, and rarer but more lasting precipitation. * * * The observer on Kerguelen will, even in midsummer, when the sun stands 60 degrees above the horizon, be reminded of winter by snow flurries, and he can never be sure whether the snowfalls which he then records should be regarded as a remnant of the bygone winter or as a forerunner of the coming one. In this disagreeable condition he may recognize a far-reaching effect of the Antarctic, extending its merciless influence through the chilly oceanic spaces into Kerguelen's latitude and beyond.

NOTES, ABSTRACTS, AND REVIEWS

AEROLOGICAL WORK OF THE GERMAN SOUTH ATLANTIC EXPEDITION ENDING APRIL, 1926 [1]

The *Meteor*, on which the scientific work of the expedition was carried out, ended her fifth "profile" cruise at Cape Town early in April, 1926. Her first five cross-Atlantic voyages took place between latitudes 28° and 64° S. Each was run for as great a distance as practicable nearly along a parallel of latitude, largely between Buenos Aires and Cape Town as bases. A comprehensive aerological program formed part of the scientific objectives of the expedition.

A total of 354 pilot balloon ascents were made. Of these, 292 averaged 3,560 m. in height. Of these again, 25 per cent passed 5,000 m.; and about 10 per cent 10,000 m., surely an excellent achievement in view of unsettled weather and relatively high winds experienced during much of the time. The intention to carry out two ascents daily was adhered to except when the weather made them impossible. This meant that many observations were made when clouds soon obscured the balloon; but the total of such cases, plus those in which kites also disappeared in the clouds, made possible a very accurate fixing of the altitudes of cloud bases on 185 occasions and for several different cloud types.

Kite flights totaled 67 for the 5 voyages, and there were determinations of cirrus direction and velocity on 46 days, many of the latter in double series.

Difficulties with the kites were numerous and persistent, especially during the earlier voyages of the series. On profile IV, the first part of the voyage was so boisterous as to call for the use of small "storm kites" and heavy wire, thus restricting the heights attained. Special trouble was encountered in the landings. The ship being often under sail to save coal, or hove to with engines going for making deep-sea soundings, the kites frequently plunged wildly in the atmospheric eddies caused by the sails or were smashed by the propellers when pressed down to the surface of the sea by gusts. Headlong dives, and sometimes the loss of the kites and instruments, followed the catching of the kite wire in the rigging. The assistant personnel frequently found itself being pulled along the slippery, heaving deck by the tugging kites. The net result of these exciting experiences was a total of 10 successful kite flights for the whole voyage on profile IV.

The last voyage was the most varied of all as regards conditions for aerological work, but nevertheless probably the most successful. Between its beginning at Buenos Aires and the first stop, Punta Arenas, the total of 20 pilot balloon ascents reached an average altitude of 8,860 m., 14 exceeded 5,000 m., 7 went beyond 10,000 m., and 1 balloon reached 20,250 m. The *Meteor* steamed thence southward via inside channels, passed out into the Southern Ocean within sight of Cape Horn, and in extraordinarily fine weather for the latitude crossed to the South Shetland Islands. She went thence to South Georgia and Bouvet Island and thence as far south as ice conditions permitted, accomplishing altogether 25 kite flights to an average height of 1,900 m. and a maximum of 3,510 m. Four flights were carried out south of latitude 64°. One flight, between South Georgia and Bouvet Island, took place close to the center of a cyclone, in thick cloud and snow squalls. It will be of interest here to quote from the report a section showing how the aerologists of the expedition met the difficulties encountered on this far southern voyage:

> The weather was generally better west of longitude 18° W., and many successful flights were there made. Nevertheless, on account of short coal supply the ship was in a number of cases not able to maneuver for the benefit of the kite work; the flights always involved a loss of time and distance. * * * The great number of flights was made possible by a change in technique. Our earlier experience had been that it was impracticable to carry out kite flights while the ship was making a sounding, because whatever might be happening to the kites the ship was not free to maneuver on account of the lead line. In many cases we lost kites on this account. Of the 25 ascents on profile V, 15 were accomplished during deep-sea soundings, the lack of safety being compensated for by using a thicker wire, the reel drum being wound with 0.8 and 0.9 mm. wire. As a result, in spite of much heavier winds, we had no breakaways.

For the whole of this last voyage, pilot balloon flights totaled 57 and the altitudes averaged 3,130 m. Of these, 11 ascents exceeded 5,000 m., 4 exceeded 10,000 m., and 1 reached 14,800 m.

The importance of the aerological work carried out by the *Meteor* in these remote latitudes can scarcely be overestimated. Interpretation of the results will be awaited with the greatest interest.—*B. M. V.*

[1] Die Deutsche Atlantische Expedition auf dem Vermessungs- und Forschungsschiff "Meteor." Part 2. See *Zeitschr. der Gesell. für Erdkunde*, Berlin, Jahrgang 1926, Nr. 5/6. Part 1 of this report appeared in the same journal, 1926, no. 1. The section on meteorology of Part 2 is by J. Reger and E. Kuhlbrodt.

Another report on the expedition, by the scientific director, Dr. A. Merz, is contained in *Sitzungsberichte der Preussischen Akademie der Wissenschaften*, 1925, XXXI, and constitutes a preliminary report on some of the scientific results. It includes a chart of the 14 profiles run by the *Meteor*. Chief among the charts showing scientific results of the expedition are: A temperature cross section for the upper 1,000 m. of depth in the South Atlantic along latitude 35° S.; a temperature cross section from latitude 70° N. to 80° S. along the meridian of 30° W. in the Atlantic; the temperature distribution at 400 m. depth in the North Atlantic; a salinity cross section from latitude 70° N. to 80° S. along 30° W. longitude.

RETURN OF THE UNIVERSITY OF MICHIGAN GREENLAND EXPEDITION OF 1926

An article by Professor Hobbs in the *Michigan Alumnus* for October 23, 1926, contains the following material of meteorological interest:

We were favored by an exceptionally good season and throughout the more than eight weeks of our stay in Greenland, Camp Little[1] was the main base of operations, particularly those with balloons, which have been unusually successful and have set new records for Greenland. We carried out no less than 90 pilot balloon ascensions for a study of the winds in the higher levels. The path of these balloons was followed with the theodolite to average heights of 7,000 meters, many to 10,000 meters, and one to 14,000 meters, or about 8 miles. * * * Thanks to a device recently invented by the Swedish meteorologist, Dr. C. G. Rossby, the Michigan expedition was able to set a new record in exploring the upper air of Greenland. Doctor Rossby had presented the expedition with three of his deflating valves, which are so made as to let the gas out of the balloon at any desired height.

The first two ascents were made to heights of about 400 and 1,700 meters, respectively, and were entirely successful, the records being recovered intact, although one fell into the fjord. We then tried for 3,000 meters and saw equipment to the value of $150 sailing away over the mountains.[2] We waved it a solemn "good-by," but, as though by a miracle, two weeks later we found it near the top of a mountain 6 miles away beyond the fjord, and the record was perfect after having reached an extreme altitude of no less than 8,000 meters. * * *

Studies of the upper air by means of the simpler pilot balloons have never before been made over or close to the vast ice caps of Greenland or the Antarctic. A party consisting of Gould, Church, Belknap, and the director, with four Greenlanders (half-caste Eskimos) in a journey of 22 days made by umiak (large skin boat), canoe, and on foot with heavy packs, reached the inland ice 100 miles away toward the interior of Greenland. Pilot balloons were there sent up and followed with the theodolite to heights in one instance of 5,500 meters, and this both close to the margin of the ice and from its surface. * * *

On one of the days when we were on the ice cap a pulse or stroph of the anticyclone was blowing down the slope and made it next to impossible for us to keep our footing. More than once we were bowled over with our heavy packs to find ourselves piled up in one of the deep gutters on the surface. * * *

Various mountain tops were visited with reference to their occupation later as a weather station for the study of the strophs of the glacial anticyclone, with special reference to the possibility of forecasting storms on the North Atlantic and in Europe. It will be necessary, however, to await the further study of the balloon observations before deciding which of these positions is best suited for the purpose.

APPLICATION OF KÖPPEN'S CLASSIFICATION OF CLIMATES TO CALIFORNIA

A paper on "Climates of California," by R. J. Russell, of Texas Technological College, constitutes part 4 of volume 2 of the University of California Publications in Geography. This part of volume 2 is an admirably concise and thoughtful presentation of the distribution of climates in California according to Köppen's scheme, supplemented by certain further subdivisions which the author shows to be desirable in order to set apart a few areas in the State which have such unusual combinations of climatic elements that the Köppen classification would be to some extent misleading. Throughout the paper Doctor Russell has carefully checked his decisions in locating the regional boundaries by adequate reference to botanical criteria and to his own extensive acquaintance with the desert and semidesert parts of the State.

The colored map accompanying the paper would, in the reviewer's opinion, have been improved by printing the letter symbols within the areas as well as in the legend. This is, however, a minor detail regarding an otherwise excellently clear picture.—*B. M. V.*

[1] Established by the expedition on an arm of Maligiak Fjord, some 50 miles east of Holstenborg, on the west coast of Greenland.—*Ed.*

[2] Mr. Fergusson, in charge of the ascents, reports that the deflating valve could not operate in this case because water vapor, from the impure hydrogen necessarily used, condensed and froze in it.—*Ed.*

AERONAUTICS AT THE CALIFORNIA INSTITUTE OF TECHNOLOGY

The "Bulletin of the California Institute of Technology" for October, 1926, announces that the institute is adding to its major branches of instruction and research new courses in aeronautics. This has been made possible through a gift of about $300,000 from the Daniel Gugenheim fund for the promotion of aeronautics. Among the 22 technological courses offered we note a course in "Aerology and meteorology," for which the following is the statement of subjects to be treated:

Variation with altitude of the pressure, wind velocity, temperature, and humidity. General circulation of the atmosphere. Prevailing winds. World's air routes. Studies relating to clouds, fogs, thunderstorm, evaporation, and atmospheric eddies. Atmospheric electricity, visibility.

Text: Shaw, Forecasting Weather.

SEVENTY-FIFTH ANNIVERSARY OF THE VIENNA ACADEMY OF SCIENCE

The editor has received a copy of the anniversary volume issued to mark the seventy-fifth anniversary of the founding of the Zentralanstalt für Meteorologie und Geodynamik, Vienna, Austria.

Following is a list of the contributors and the titles to be found in the volume:

Vorwort, Dr. Felix M. Exner.

P. Th. Schwarz, Einfluss der Thermometeraufstellung auf die Beobachtungsresultate der Temperatur in Kremsmünster.

Ficker, H. v., Richtung von Wind und Wolken auf Teneriffa.

Wegener, A., Beobachtungen der Dämmerungsbögen und des Zodiakallichtes in Grönland.

Exner, F. M., Beziehungen von Luftdruckanomalien auf der Erde zueinander.

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Kofler, M., Eine einfache Definition der Unruhe einer Naturerscheinung.

Pircher, J., Apparat zur Registrierung der Böigkeit des Windes, angeschlossen an Dines' Anemographen.

Conrad, V., Schwankungen der seismischen Aktivität in verscheidenen Faltungsgebieten.

Wagner, A., Windregistrierungen auf dem 150 m. hohen Funkturm in Deutsch Altenburg.

Schmidt, W., Modellversuche zur Wirkung der Erddrehung auf Flussläufe.

HURRICANE AT BERMUDA, OCTOBER 22, 1926

W. H. Potter, of Bermuda, has sent the following account, to which we add a table of pressure and wind velocities taken from The Royal Gazette and Colonist Daily, Bermuda, for October 25, 1926.

The tropical disturbance which passed over Bermuda on October 22d, 1926, was unique in that it gave no preliminary warnings of its approach. Usually they do. The storm that passed near here on August 6th heralded its approach on the 2d by a very heavy swell on the south shore which kept increasing as the storm came nearer. If it had not been for the warnings issued by the Weather Bureau, no one would have considered the possibility of a hurricane until the storm broke; even with these warnings, it seemed doubtful.

On October 18th, 19th, and 20th the barometer, while rather low was steady, the weather clear and warm. Wind W., moderate, but light on the 20th, veering through NE. to SW. by the 21st. On the 21st the sky was overcast with alto-stratus, but not the uniform pall that precedes hurricanes, but of different thicknesses which grew heavier and lower as the day went on. The wind was SW., light, and the barometer fell very slowly. The symptoms were exactly those that obtain when an ordinary LOW passes to the north of us and the indications were, rain in the night followed by clearing with W. to NW. winds next day. It rained in the night hard.

At 7:30 a. m. of the 22d the barometer had taken a big drop, wind backed to SE. and rain was still falling and the graph seemed to be flattening out. This would indicate that the storm was passing to the north and had reached its climax. Suddenly at 7:45 the wind backed to ENE., increased with heavy gusts, the barometer began its rapid fall and then there was no doubt what we were in for, and from then on was a conventional hurricane.

The calm center was rather large, taking about 40 minutes to pass, the wind backing through NE. to NNW. The wind blew harder and all the damage was done in the second half and its velocity was at least 120 m. p. h. Apart from two houses, unoccupied, destroyed in Hamilton, the damage, while rather large in the aggregate, was for the most part small individually. The roofs of probably 40 per cent of the houses were more or less damaged. No one was killed and one slightly injured, and there was no damage to speak of to the small boats in the harbor. The telephone was hit hard, but the electric lights were on in Hamilton by 7 p. m. the 22d, and here across the harbor by the next evening.

Following is the barometer and wind table, prepared by Sergt. W. R. Green, R. A. M. C., the observer at Prospect.

Barometer		Wind		
Hour	Inches	Hour	Actual m. p. h.	Direction
8 a. m.	29.54	7:30- 8:30 a. m.	28	SE.
		8:30- 9:30 a. m.	45	Changeable between SE. and NE.
		9:30-10:30 a. m.	[1] 68	Do.
		10:30-11:30 a. m.	47	Do.
11 a. m.	28.58	11:30-12:30 p. m.	[2] 28	Do.
		12:30- 1:30 p. m.	114	NW.
3 p. m.	29.50	1:30- 2:30 p. m.[3]		

[1] It blew at the rate of 95 miles per hour from 10 a. m. to 10:15 a. m.
[2] It blew at the rate of 8 miles per hour between 11:45 a. m. and 12 noon.
[3] No record taken after 1:30 p. m.
At 12 noon the direction of the wind changed to NW.
Rainfall 4.50 inches.

The original barograph trace made at Paget, Bermuda, and kindly loaned to us by Mr. Potter, shows a finely developed deep V form: An uninterrupted and precipitous fall from (uncorrected) 29.75 inches at 7:45 a. m. to slightly below 28.75 inches shortly after noon, followed by a rise, not quite as rapid as the fall, beginning about 12:30 p. m. and reaching approximately 29.80 at about 6:30 p. m. The trace did not reach 30.00 inches until 7 a. m. the next day. Mr. Potter comments as follows upon this barogram:

"Unfortunately the pen was a bit sluggish. While it registered at 8. a m. the 22d the same as the standard barometer at Prospect, it lacked 8 or 10 points of reaching the minimum at noon."

AN EARLY MORNING TORNADO AT BERMUDA

B. M. V.

It is rare indeed for six barographs to be grouped within a very few hundred yards of a tornado, two of them recording its passage in unmistakable form. This happened at Bermuda on December 12, 1925, as reported in *The Marine Observer* for December, 1926. The barographs were variously located on ships in Ireland Island Dock Yard, or in the office buildings of the yard. The two barographs which, at 5:25 a. m., registered sharp drops in pressure were: One in an office on one side of the whirl; another on board H. M. S. *Ormonde* on the other side. The one in the office, apparently nearest the center, recorded an instantaneous drop of some 6 mb.; that on the *Ormonde* a similar drop of about 4 mb. (Reproductions of these in the journal cited.) To quote from the account:

Ormonde's quartermaster reported that the wind was only audible for some 15 seconds before it burst upon the ship, and its duration was approximately 30 seconds, which did not enable him to get a reading of the anemometer—the ship heeled violently over to starboard, brought up against the wires and then heeled over, about 15° to port.

Many buildings were damaged in some way or another, tiles ripped off, small sheds capsized, and fences blown down. A whaler belonging to *Capetown* on the chocks at the boat slip was shifted 12 feet and badly holed. The 10-ton crane abreast *Ormonde's* bridge was swung right round and a cart close to it turned over * * *.

It was also said that a dock-yard policeman had a stormy passage up the jetty and was only saved from a ducking by fetching up against a bollard.

The breadth of the path of tornado is estimated to be about 300 yards.

THE WEATHER FORECAST SERVICE AT THE OBSERVATORIO DEL SALTO, SANTIAGO, CHILE

The following excerpts are taken from a bulletin prepared by the director of the Observatorio del Salto.

SHORT-RANGE FORECASTING

* * * The Government maintains throughout the length of the country a complete net of meteorological stations extending from Arica to Punta Arenas * * *. The observations are telegraphed to Santiago. Though there is really an excess of stations, in our forecasting we use only the observations from the most important ones * * *.

The following stations are taken as a basis for the construction of our meteorological charts: *In Chile:* Arica, Iquiqui, Antofagasta, Caltal, Coquimbo, Los Andes, Valparaiso, Santiago, San Fernando, Curico, Talca, Chillan, Concepcion, Traiguen, Temuco, Valdivia, and Puerto Montt. We receive also twice a day by radio observations from the following remote stations: Coquimbo, Isla Juan Fernandez, Punta Tumbes, Isla Mocha, Isla Huafo, Cabo Raper, and Punta Arenas. *Bolivia:* From Bolivia there is a special telegraphic transmission of observations made at La Paz and Sucre, which are furnished also to the Observatory of San Calixto. *The Argentine:* Mendoza, Cordoba, San Luis, Buenos Aires, Bahia Blanca, Patagones de Rio Negro, Chosmalal, Las Lajas, Cipolleti, Puerto Madryn, and Bariloche. After all the observations have been assembled we construct a meteorological chart for all of southern South America. including Bolivia, Chile, and Argentina * * *. In our daily forecasting we use with most satisfactory results the methods of Guilbert, which permit us to foretell the occurrence of the various isobaric types * * *.

The forecasts are broadcast throughout the country daily. At 10 a. m. the morning bulletin is issued, which is broadcast by radiophone and published in the afternoon papers. At 4 p. m. a bulletin is wired to the provincial dailies. At 10 p. m. a general bulletin is issued to the press and broadcast from three radiophone stations.

We publish weekly in the press a verification of the daily forecasts. The weather that was forecast and the weather which occurred appear in parallel columns. In this way there is a rigid check upon the forecasts. The results obtained are highly satisfactory; during the first half of 1926 the percentage of hits did not as a rule fall below 80, and occasionally exceeded 95.

WEEKLY FORECASTS

El Salto Observatory established in 1925 a weekly forecast service, based upon computations of the solar radiation * * *. The observatory includes a special solar station equipped with a rotating metallic dome, an equatorial Mailhat telescope, a pyrheliometer for measuring solar radiation, astrophysical cameras, etc. Daily observations are made of the sunspots and faculæ, of which a diagram is prepared, attached to which are the photographic evidences; this is sent to the forecast office. Observations of solar radiation are sent daily to the observatory by wire from the Montezuma Observatory of the Smithsonian Institution * * *.

In calculating our weekly forecasts we use Clayton's method, based on the relations which exist between solar phenomena and solar radiation. In addition, Mr. William Hoxmark, in charge of weekly forecasts at the Argentine Meteorological Office wires us daily from Buenos Aires his calculations on the variations of temperature and rainfall in the region of the Plata River. With these data we complete our forecasts.

The weekly forecast is issued to the press of the whole country at 4 p. m. on Saturday and is printed on Sunday and Monday. The results obtained have been most satisfactory, especially in the forecasting of rainy periods and of temperature changes. The percentage of hits varies between 75 and 80.

CONCLUSION

In addition to our daily and weekly forecast services the observatory prepares each month for agricultural interests the general indications as to temperature probabilities deduced from the periodic variations of solar radiation in the 11, 17, and 28 day cycles. These forecasts, which are much less detailed in character than the others, will naturally be further perfected in future.

Moreover, in our work upon "Solar Radiation and Rainfall in the Central Zone of Chile, 1850–1925," we have succeeded in establishing a clear relation between the 11-year period in solar activity and rainfall. This will permit us in future to indicate on a scientific basis the periods of dry years and wet years.

All our forecasts are carefully checked, since we carry on simultaneously both verification and scientific investigation. We construct monthly graphic comparisons of the variations of solar radiation and the different meteorological elements over the country. The conclusions so far arrived at confirm in a gratifying way the results obtained by Clayton and other investigators.

We hope that this new method of weather forecasting, based on short-period variations of solar radiation, marks the initial phase of a new development in the progress of meteorology.—*Translation by B. M. V.*

METEOROLOGICAL SUMMARY FOR SOUTHERN SOUTH AMERICA, SEPTEMBER, 1926

By Sr. J. B. NAVARETTE, Director

[Observatorio del Salto, Santiago, Chile]

During September the atmospheric circulation over the southern region was active, while off the central zone an anticyclonic régime was dominant almost continuously, with highest pressure at the island of Juan Fernandez. Under these conditions the weather in the central zone was dry and cloudy; but, on the contrary, there were rather more frequent rains in the southern region.

On the 1st a depression affected the far south, giving heavy showers as far north as Concepcion. At Valdivia 61 mm. fell. On the 2d and 3d the pressure rose, and then on the 4th a new depression caused rain up to Valdivia and Cautin. Unsettled weather followed until the 6th, relatively low pressure lying off Punta Tumbes and causing rain in the central zone, and rain on the 7th from Coquimbo to Concepcion. On the 9th another depression crossed the southern region, giving showers as far north as Llanquihue. Bad weather lasted in the south until the 15th.

During nearly the whole of the second decade the dominating influence was the center of high pressure at the island of Juan Fernandez, the barometer becoming variable toward the south. On the 18th, 23d, and 26th–30th important depressions crossed the far south, causing bad weather and rains there.—*Transl. B. M. V.*

METEOROLOGICAL SUMMARY FOR BRAZIL, 1926

By FRANCISCO SOUSA, Acting Director

[Directoria de Meteorologia, Rio de Janeiro]

During this month the circulation of the lower atmospheric strata was rather active, for six anticyclones invaded the southern part of the continent, in addition to which the continental depressions of higher latitudes were very active, principally in the last decade, when strong gales occurred in the southern regions and to some extent also in the center of the country.

Rains recorded in the northern zone reached but a scant total; this was 15 mm. below normal. In the central zone rainfall was still further below normal, the deficiency being 35.2 mm. Rainfall in the southern zone was irregular, but came to 44.9 mm. above the normal. In Rio Grand do Sul the total was very high, reaching an average value of 156.4 mm. above normal. By virtue of excessive rains which occurred in the basins of the Gravatahy, Jacuhy, and Guahyba Rivers, the city of Porto Alegre, capital of Rio Grand do Sul, suffered one of the most devastating floods in its history, comparable only to the flood of 1873.

The harvest of cotton in northern Brazil will be small, owing to reduction of the cultivated area. The coffee plantations are in fine condition, and promise excellent yield. The sugar-cane crop promises a good yield, especially in the States of Pernambuco, Rio, Minas Geraes, and Sao Paulo; in the States of Santa Catharina and Sao Paulo the fields are already being prepared for planting.

The weather at Rio was generally unsettled, with light rains which were, however, somewhat heavier in the first two decades. The rainfall record shows a small total. The temperature was a little high for the time of year, the monthly mean being 1.5° C. above normal. The nights were less cool than in the preceding month, the mean minimum being 2.6 above normal. The absolute maximum occurred on the 5th, with 33.3° C.

On the 1st, 19th, 21st, and 22d gales from southerly directions occurred, with maximum velocities varying from 16 to 20 m. p. s.—*Transl. W. W. R. and B. M. V.*

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Aéronautique. Paris. 8 année. Octobre 1926.
Brion, M. L'anémographie. Les méthodes d'apprentissage et la securité. p. 338–339.

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Mathias. Sur les phénomènes lumineux et sonores des éclairs fulgurants. p. 261–262.

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Mackenzie, Stuart. Don't apologize for talking about the weather! p. 44–46; 198; 200; 202. (Feb.)
Mackenzie, Stuart. When winter comes. p. 38–40; 161–166. (March.)
Mackenzie, Stuart. How many tons of rain will fall on your town? p. 38–39 & ffg. (Apr.)
Mackenzie, Stuart. Wind! a star performer in the drama of American life. p. 40–41 & ffg. (May.)
Mackenzie, Stuart. Our tornadoes are the fiercest of all storms. p. 38–40; 80. (June.)

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Brombacher, W. G. Compensation of altimeters and altigraphs for air temperature. p. 98. [Abstract.]
Brooks, Charles F. Gulf Stream variations and rainfall. p. 88–89. [Abstract.]
Casey, Harry J. Weather observation work of a public utility. p. 92–96. [Abstract.]
Fisher, J. C. On certain features of the spray and harvest weather services in New York state. p. 85–86. [Abstract.]
Fisher, J. C. The weather element in the control of apple scab. p. 86–87. [Abstract.]
Flora, S. D. Tornadoes of the middle west. p. 81–84.
Miller, Hazel V. Temperature variations in the Gulf Stream in the Straits of Florida, 1917–1921. p. 87–88. [Abstract.]
Nunn, Roscoe. Duration of precipitation at Baltimore. p. 96–97. [Abstract.]
Tingley, F. G. Recent surface water temperatures in Central American waters and their possible relation to the weather. p. 89–92. [Abstract.]

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Everdingen, E. van. Gibt es stationäre glaziale Antizyklonen? p. 18–19.
Exner, Felix M. Über den Einfluss von Luftdruckänderungen auf die vertikale Temperaturverteilung. p. 20–26.
Ficker, H. v. Temperatur und vertikale Temperaturabnahme auf Teneriffa. p. 27–32.
Gentzen, C. Ergebnisse der meteorologischen Beobachtungen von Hamburg im System der Deutschen Seewarte für die 50 Jahre 1876 bis 1925. p. 33.
Georgi, J. Einfluss einer Insel auf die Luftströmung. p. 34–37.
Grosse, W. Erhöhung der Jahresmitteltemperatur im Gebiet des Nordatlantischen Ozeans. p. 38–41.
Heidke, P. In sich homogene und relativ homogene meteorologische Beobachtungsreihen sowie Reduktion einer Reihe auf eine oder mehrere andere. p. 42–53.
Hellmann, G. Beitrag zur Frage nach der Eintrittszeit des täglichen Maximums der Lufttemperatur auf dem Meere. p. 54–56.
Keppler, W. Die Temperaturverhältnisse am Bodensee bei kalten, ablandigen Winden. p. 68–71.

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Schmauss, A. Die Häufigkeit bestimmter Luftdruckwerte an bestimmten Tagen. p. 72-74.

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SOLAR OBSERVATIONS

SOLAR AND SKY RADIATION MEASUREMENTS DURING OCTOBER, 1926

By HERBERT H. KIMBALL, Solar Radiation Investigations

For a description of instruments and exposures and an account of the method of obtaining and reducing the measurements, the reader is referred to the REVIEW for January, 1924, 52:42, January, 1925, 53:29, and July, 1925, 53:318.

From Table 1 it is seen that solar radiation intensities averaged close to the October normal at Lincoln, Nebr., above the normal at Madison, Wis., and at Washington, D. C., below normal in the morning and above in the afternoon. City smoke is no doubt at least partly responsible for the decrease of solar radiation intensities at Washington during the morning hours.

Table 2 shows a deficiency in the amount of radiation received on a horizontal surface from the sun and sky at all three stations for which normals have been determined.

At Washington skylight polarization measurements made on three days give a mean of 57 per cent, with a maximum of 60 per cent on the 9th. At Madison, measurements obtained on four days give a mean of 67 per cent, with a maximum of 70 per cent on the 26th. The Washington values are below the corresponding averages for October. Those for Madison are close to October averages for that station.

TABLE 1.—*Solar radiation intensities during October, 1926*

[Gram-calories per minute per square centimeter of normal surface]

Washington, D. C.

Date	Sun's zenith distance										
	8 p.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
	e.	5.0	4.0	3.0	2.0	[1] 1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
Oct. 3	15.65					1.23					15.65
4	17.37			0.70	0.85		0.95	0.76			18.59
5	17.37			0.80	1.03						16.79
7	5.79		0.82	0.98	1.17						5.56
8	6.02	0.64	0.74	0.93	1.10						5.79
9	7.57	0.82	0.92	1.06	1.25	1.54	1.27	1.08	0.88	0.79	4.75
14	10.59	0.69	0.81	0.94							9.14
15	9.14		0.53	0.67							7.29
19	7.29				1.26	1.49	1.26	1.06	0.89	0.81	6.02
21	5.79				1.05						5.16
22	5.79		0.71	0.84	1.05	1.34	1.03				5.56
26	2.74				1.22						3.15
27	4.57	0.51	0.67	0.80	1.02						3.15
28	4.95	0.60	0.73	0.88	1.07	1.42	1.15	0.92	0.78	0.64	4.75
Means		0.65	0.74	0.86	1.10	1.40	1.13	0.96	0.85	0.75	
Departures		−0.12	−0.10	−0.08	−0.01	−0.05	+0.02	+0.03	+0.05	+0.05	

[1] Extrapolated.

TABLE 1.—*Solar radiation intensities during October, 1926*—Con.

Madison, Wis.

Date	Sun's zenith distance: 8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass: A. M.					P. M.				Local mean solar time
	e.	5.0	4.0	3.0	2.0	[1] 1.0	2.0	3.0	4.0	5.0	e.
	mm.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm.
Oct. 7	4.57	------	------	0.95	1.21	1.45	1.27	1.10	------	------	4.95
13	4.95	------	0.90	1.01	1.25	------	------	------	------	------	5.36
26	2.74	------	------	1.19	1.32	1.45	1.33	------	------	------	2.87
29	4.75	------	------	1.00	1.15	------	------	------	------	------	4.37
Means	------	------	(0.90)	1.04	1.23	(1.45)	(1.30)	(1.10)	------	------	------
Departures	------	------	−0.03	−0.02	+0.04	+0.07	+0.11	+0.08	------	------	------

Lincoln, Nebr.

Date	8 a.m. e.	5.0	4.0	3.0	2.0	1.0	2.0	3.0	4.0	5.0	Noon e.
Oct. 1	6.50	0.83	0.95	1.08	1.24	1.42	------	1.02	0.84	0.68	5.16
4	5.79	------	------	------	1.26	1.42	------	------	------	------	7.87
6	6.02	0.67	0.88	1.14	1.29	1.46	------	------	------	------	6.50
7	7.04	------	------	------	1.21	1.43	1.14	------	0.91	0.79	9.83
8	9.14	0.82	0.92	1.05	1.21	1.39	------	------	------	------	11.38
13	5.36	------	------	------	------	1.44	1.25	1.09	0.95	0.83	6.27
14	6.02	0.91	1.00	1.14	1.36	------	------	------	------	------	5.36
20	4.37	------	1.09	1.22	1.36	1.53	1.39	1.20	1.04	0.95	4.57
26	4.57	1.09	1.15	1.24	1.39	1.55	------	------	------	------	4.37
Means	------	0.86	1.00	1.14	1.29	1.46	1.26	1.10	0.94	0.81	------
Departures	------	−0.03	+0.03	+0.02	±0.00	−0.04	±0.00	+0.01	−0.02	−0.04	------

TABLE 2.—*Solar and sky radiation received on a horizontal surface*

[Gram-calories per square centimeter of horizontal surface]

Week beginning—	Average daily radiation: Washington	Madison	Lincoln	Chicago	New York	Average daily departure from normal: Washington	Madison	Lincoln
1926	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.
Oct. 1	312	208	328	144	223	−16	−76	−24
8	274	246	246	163	213	−33	−10	−78
15	224	140	309	126	157	−63	−89	+15
22	239	216	266	134	151	−25	+10	+2
Deficiency since first of year on Oct. 28						−4,858	−1,302	−2,492

WEATHER OF NORTH AMERICA AND ADJACENT OCEANS

NORTH ATLANTIC OCEAN

By F. A. YOUNG

October was an exceptionally stormy month and the number of days with gales was considerably above the normal over the greater part of the ocean. Several tropical disturbances occurred during the month, three of which were of slight intensity, but the storm that created such havoc in Cuba on the 20th was one of the most severe on record. In addition to the notes herein regarding these disturbances other particulars appear elsewhere in the REVIEW.

The number of days with fog was apparently below the normal over the entire ocean. As usual, the greatest amount occurred over the Grand Banks, where it was reported on 8 days; it occurred on from 3 to 7 days over the middle section of the steamer lanes, from 3 to 4 days off the American coast, and from 1 to 5 off the coast of northern Europe.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressures at sea level, 8 a. m. (75th meridian), North Atlantic Ocean, October, 1926*

Stations	Average pressure	Departure [1]	Highest	Date	Lowest	Date
	Inches	Inch	Inches		Inches	
Julianehaab, Greenland	[2] 29.76	([3])	30.16	[4] 16th.	29.10	1st.
St. Johns, Newfoundland	29.86	−0.06	30.14	25th.	29.02	19th.
Nantucket	29.95	−0.07	30.40	1st.	29.38	25th.
Hatteras	30.02	−0.01	30.30	2d.	29.58	25th.
Key West	29.94	−0.04	30.12	28th.	29.70	20th.
New Orleans	30.01	0.00	30.20	27th.	29.74	24th.
Swan Island	29.78	−0.13	29.93	29th.	29.56	19th.
Turks Island	29.96	+0.01	30.06	[4] 29th.	29.80	15th. [4]
Bermuda	30.06	+0.04	30.30	31st.	29.54	22d.
Horta, Azores	30.07	−0.05	30.34	[4] 8th.	29.60	20th. [4]
Lerwick, Shetland Islands	29.79	0.00	30.52	4th.	28.83	9th.
Valencia, Ireland	29.93	+0.02	30.55	4th.	29.47	22d.
London	29.91	0.00	30.55	4th.	29.31	29th.

[1] From normals shown on H. O. Pilot Chart, based on observations at mean noon, or 7 a. m., 75th meridian.
[2] Mean of 24 observations; seven days missing.
[3] No normal established.
[4] And on other dates.

On the 1st and 2d high pressure prevailed generally along the American coast, and from the 1st until the 5th over the British Isles. On the 2d a LOW, central near 44° N., 39° W., was accompanied by moderate northerly gales in the westerly quadrants.

On the 3d an area of low pressure covered Newfoundland, and vessels between St. Johns and the 40th parallel reported moderate southwesterly gales.

On the 3d and 4th the cable steamer *Henry Holmes* encountered winds of gale force in the vicinity of St. Lucia, as shown in table.

On the 4th the Newfoundland LOW of the 3d was central near 50° N., 40° W., and stormy weather still prevailed over a limited area between the 40th and 50th parallels and 40th and 55th meridians.

On the 5th and 6th comparatively high pressure and moderate winds were the rule over the ocean, except that on the latter date Belle Isle was near the center of a depression that remained in that vicinity until the 13th, although it was surrounded for the most part by moderate winds.

On the 8th a LOW was central near 57° N., 12° W., that afterwards developed into a very severe disturbance, as it moved eastward. On the 9th the storm area extended from the 45th to 60th parallels, and from the 5th meridian, east, to the 20th, west, and the land stations on the British Isles reported winds of force 6 to 9, with barometric readings as low as 28.82 inches. This disturbance moved rapidly eastward and on the 10th was in the vicinity of the North Sea, where strong northwesterly gales prevailed throughout the 12th.

On the 12th a well-developed LOW was central near 55° N., 32° W., with strong westerly gales in the southerly quadrants. On the same day there was also a secondary LOW of comparatively slight intensity off the west coast of Ireland. By the 13th these two LOWS had evidently combined and were now over the North Sea. On the 13th

there was also a disturbance near 45° N., 45° W., that moved steadily eastward, its center on the 14th being near 47° N., 32° W. Judging from reports received, this LOW suddenly curved southward and then recurved toward the northeast, as on the 15th it was central near 40° N., 35° W., and on the 16th near 48° N., 21° W. It moved but little during the next 4 days and gradually filled in.

From the 13th to 15th gale reports were received from vessels in widely scattered parts of the ocean, while on the 16th and 17th the stormy conditions were confined to a limited area over the eastern section of the steamer lanes.

On the morning of the 18th the tropical disturbance previously referred to was in the vicinity of Swan Island. On the same day there were also areas of low pressure off the coast of Newfoundland and over the eastern section of the steamer lanes, both LOWS being accompanied by moderate to strong gales. On the 18th there was also a shallow depression central near 35° N., 52° W., that was surrounded by moderate winds.

On the 19th the tropical disturbance was in the vicinity of the Isle of Pines, while the two northern LOWS of the 18th had changed but little in position and intensity. The shallow depression moved rapidly eastward, increasing in intensity, and on the 19th was central near 32° N., 37° W., with strong southerly gales in the easterly quadrants.

On the 20th, as shown on Chart VIII, the tropical disturbance was over the Florida Straits, with moderate weather the rule over the remainder of the ocean, although a well-defined LOW was central near the Azores.

Charts IX to XIII cover the period from the 21st to 25th, inclusive, and give an idea of the track of the tropical hurricane of that period. On the 25th this storm was central near 38° N., 43° W., while both the American and European coasts were being swept by severe gales.

By the 26th the tropical storm had practically filled in, although gales were reported near 33° N., 47° W., as shown by storm reports. On the 26th there were also LOWS over the province of Quebec, in the mid-eastern section of the steamer lanes, and over the North Sea, with moderate to strong gales near the respective centers. By the 27th, the LOW over the steamer lanes had moved eastward and was now central near 50° N., 17° W., with heavy weather prevailing between the 5th and 30th meridians.

On the 27th there was a depression near 37° N., 67° W., that afterwards developed in intensity, although of limited extent. On the 28th the center of the northern LOW was near the English Channel, while the storm area extended from the 40th to 55th parallels and 10th to 30th meridians. During the next 48 hours this disturbance moved but little and gradually filled in. On the 30th Belle Isle was near the center of a LOW, and on the same day there was also an area of low pressure off the coast of southern Europe.

On the morning of the 31st southwesterly winds of force 3 to 5 were reported along the American coast between Hatteras and the Virginia Capes that afterwards increased to moderate gale force. On the 31st there was a severe disturbance near 55° N., 27° W., and moderate to strong gales swept the steamer lanes between the 15th and 30th meridians.

OCEAN GALES AND STORMS, OCTOBER, 1926

Vessel	Voyage		Position at time of lowest barometer		Gale began	Time of lowest barometer	Gale ended	Lowest barometer	Direction of wind when gale began	Direction and force of wind at time of lowest barometer	Direction of wind when gale ended	Highest force of wind and direction	Shifts of wind near time of lowest barometer
	To—	From—	Latitude	Longitude									
NORTH ATLANTIC OCEAN			° ′	° ′				Inches					
Tuscaloosa City, Am. S. S.	Port Said	Boston	40 06 N.	43 00 W.	Oct. 2	2a., 2	Oct. 4	29.65	N	N	NW	NNW., 10	
Henry Holmes, Br. S. S.	St. Thomas	St. Vincent	Off St. Lucia		3	7p., 3	4	29.80	Var	SE., 6	SE	—, 8	ESE.-SE.
Lord Antrim, Br. S. S.	Sydney, N. S.	Belfast	55 02 N.	18 24 W.	8	9 p., 8	9	29.38	W	WNW., 7	NW	NW., 8	W.-NW.
Brush, Am. S. S.	Galveston	Rotterdam	36 00 N.	70 38 W.	9	4 p., 9	10	29.90	NNW	NNW., 7	NW	NNW., 8	Steady.
Stockholm, Swed. S. S.	New York	Gothenburg	58 22 N.	9 35 W.	9	5 a., 9	11	28.93	NNW	NE., 6	W	NE., 10	NW.-N.-NE.
Effingham, Am. S. S.	Hamburg	Pensacola	53 32 N.	8 42 E.	9	5 a., 10	10	28.77	SW	WSW., —	SW	NW., 10	W.-WSW.
Breedijk, Du. S. S.	Rotterdam	Montreal	53 00 N.	29 35 W.	11	11p., 11	12	29.36	WSW	WSW., 5	NNW	W., 10	
West Hika, Am. S. S.	Mobile	Bremen	48 37 N.	22 41 W.	14	Noon, 14	19	29.53	NE	E., 9	ESE	E., 9	NE.-E.-ESE.
Nieuw Amsterdam, Du. S. S.	New York	Rotterdam	48 40 N.	25 34 W.	16	6 a., 16	17	29.86	ENE	ENE., 7	E	ENE., 9	Steady.
Columbus, Ger. S. S.	Cherbourg	New York	48 38 N.	28 50 W.	17	Mdt., 17	18	29.71	E	NE., 6	NE	—, 9	
Atenas, Am. S. S.	New Orleans	Cristobal	16 30 N.	82 15 W.	18	Noon, 18	19	28.75	NE	Calm	SSE	S., 12	N.-Calm.-S.
Topa Topa, Am. S. S.	do	Glasgow	41 21 N.	53 28 W.	18	7 p., 18	18	29.36	SE	SE., 11	NE	SE., 11	SE.-NE.
Mojave, Am. S. S.	Providence	Colon	18 30 N.	82 50 W.	18	1 a., 19	19	28.06	NE	ENE., 12	SSE	—, 12	ENE.-N.-SSW.
Selma City, Am. S. S.	Mobile	San Pedro	20 28 N.	84 19 W.	19	4 p., 19	20	29.14	NE	NE., 12	SW	—, 12	NE.-N.
St. Joseph, Fr. S. S.	Havre	Colon	30 55 N.	35 43 W.	19	2 p., 19	19	29.48	S	SSE., 8	SW	SSE., 10	SSE.-SW.
Zacapa, Am. S. S.	New York	Central America.	24 24 N.	80 54 W.	20	6 p., 20	21	28.24	E	NW., 12		—, 12	E.-NE.-NW.
Ulua, Br. S. S.	do	Habana	24 04 N.	82 12 W.	20	2 a., 20	20	29.07	ENE	N., 12	NNW	N., 12	NNE.-NNW.
San Blas, Br. S. S.	Habana	Limon	23 20 N.	83 00 W.	19	10 a., 20	20	29.44	E	NNE., 10	NNW	NNE., 12	Steady.
Cripple Creek, Am. S. S.	Galveston	Liverpool	48 07 N.	26 52 W.	20	7 p., 20	23	29.78	ESE	ENE., 10	NW	ENE., 10	NNE.-N.
H. H. Asquith, Br. S. S.	Colon	Newark	26 48 N.	76 25 W.	21	1 p., 21	21	28.44	SSE	S., 12	NW	S., 12	S.-SW.-NW.
Woensdrecht, Du. M. S.	Thameshaven	Texas City	27 25 N.	73 45 W.	21	—, 21	21	28.08	SE	—, 12	NNW	—, 12	SE.-W.
Motocarline, Belg. S. S.	Baton Rouge	Antwerp	40 12 N.	37 26 W.	21	Noon, 21	22	29.52	NW	NW., 7	NW	NW., 9	
Tulsa, Am. S. S.	Antwerp	Jacksonville	33 07 N.	68 16 W.	22	12.30 p., 22	22	29.14	SSE	NNE., 12	N	NNE., 12	NE.-NNE.
Nitonian, Br. S. S.	do	Galveston	29 29 N.	64 13 W.	21	8 a., 22	22	29.43	SSW	S., 6	NNW	WSW., 11	SSW.-W.-N.
Brush, Am. S. S.	Galveston	Rotterdam	49 30 N.	17 12 W.	21	4 p., 22	23	29.60	NE	N., 10	NE	N., 10	NE.-N.
San Guerer, Br. S. S.	Tuxpam	London	35 20 N.	62 40 W.	22	9 p., 22	23	29.28	NNE	N., 10	NW	NNW., 12	N.-NNW.
Kerhonkson, Am. S. S.	Londonderry	Norfolk	40 05 N.	70 15 W.	24	6 p., 24	25	29.80	SE	SE., 7	SW	SW., 10	SW.-W.
St. Andrew, Br. S. S.	Rotterdam	Galveston	38 50 N.	45 00 W.	24	Noon, 24	25	29.06	SSW	SW., 10	NNE	NW., 10	SSW.-NW.
Stockholm, Swed. S. S.	Gothenburg	New York	40 30 N.	69 42 W.	25	7 p., 25	25	29.38	S	SW., 9		SSW., 11	S.-SW.-W.
Texas, Fr. S. S.	Havre	New Orleans	33 42 N.	44 12 W.	25	10 p., 25	26	29.51	W	SE., 9	E	WSW., 10	WSW.-SE.
Welshman, Br. S. S.	Avonmouth	Montreal	50 16 N.	33 16 W.	25	8 a., 25	26	29.25	SW	NW., 8	NNE	—, 10	W.-NW.
Minnekahda, Am. S. S.	New York	Plymouth	50 15 N.	4 12 W.	24	Noon, 25	26	29.25	WNW	NW., —	NW	NW., 9	WNW.-NW.
Adra, Br. S. S.	Portland, Eng.	Hampton Roads.	46 06 N.	24 04 W.	26	Noon, 26	27	29.48	WNW	WNW., —	N	—, 11	Steady.
Topa Topa, Am. S. S.	New Orleans	Glasgow	53 46 N.	19 52 W.	25	4 p., 26	26	29.34	SE	SE., 5	E	SE., 10	SE.-E.
Hog Island, Am. S. S.	Gibraltar	New York	37 42 N.	67 10 W.	27	Mdt., 27	29	29.65	NW	NW., 9		NW., 9	SE.-NW.
Canadian Freighter, Br. S. S.	Glasgow	Colon	44 20 N.	21 15 W.	26	4 a., 27	28	29.27	SW	WNW., 9	N	NNW., 10	WNW.-N.
Topa Topa, Am. S. S.	New Orleans	Glasgow	54 14 N.	18 04 W.	27	4 a., 27	28	29.34	E	ENE., 2	NE	NE., 11	E.-NE.
Amsterdam, Du. S. S.	Amsterdam	Baton Rouge	31 45 N.	55 10 W.	28	2 p., 28	29	29.85	SSE	SW., 10	WNW	SW., 10	SSW.-SW.
Athelmere, Br. S. S.	Batoum	London	42 53 N.	9 20 W.	27	2 a., 29	20	29.05	S	N., —	N	N., 9	Steady.
Colonian, Br. S. S.	Montreal	Avonmouth	55 59 N.	24 33 W.	30	7 p., 31	Nov. 1	29.18	SE	W., 8	W	ESE., 10	SSW.-WSW.
Hoxie, Am. S. S.	Hampton Roads.	Glasgow	55 12 N.	15 45 W.	31	4 p., 31	1	29.66	SSE	SSE., 8	WSW	SSE., 11	SSE.-SSW.

Ocean gales and storms, October, 1926—Continued

Vessel	Voyage: To—	Voyage: From—	Position at time of lowest barometer: Latitude	Position at time of lowest barometer: Longitude	Gale began	Time of lowest barometer	Gale ended	Lowest barometer	Direction of wind when gale began	Direction and force of wind at time of lowest barometer	Direction of wind when gale ended	Highest force of wind and direction	Shifts of wind near time of lowest barometer
NORTH PACIFIC OCEAN			° ′	° ′				Inches					
Yankee Arrow, Am. S. S.	Shanghai	Los Angeles	33 01 N.	135 38 E.	Oct. 1	6 p., 3	Oct. 3	29.85	N	N., 8	N	N., 8	N.-ENE.
Shidzuoka Maru, Jap. S. S.	Yokohama	Victoria	48 48 N.	145 20 W.	2	8 p., 2	4	29.43	ESE	ENE., 5	S	SSE., 8	ENE.-SSE.
Shabonee, Br. S. S.	San Pedro	China	33 18 N.	150 52 E.	2	9 p., 2	2	29.55	S	SW., 10	W	SW., 10	S.-SW.-W.
Gyokoh Maru, Jap. S. S.	Bellingham	Kobe	41 20 N.	148 06 E.	2	2 p., 2	2	29.18	SSE	SW., 8	WNW	SE., 9	8 pts.
Pres. Lincoln, Am. S. S.	San Francisco	Manila	34 50 N.	152 30 E.	2	11 p., 2	3	28.45	S	SW., 12	NW	SW., 12	S.-NNW.
West Prospect, Am. S. S.	do	Yokohama	35 24 N.	152 20 E.	2	10 p., 2	3	29.36	S	S., 6	NW	N., 10	
William Penn, Am. S. S.	Honolulu	Balboa	14 05 N.	104 21 W.	2	6 p., 2	3	29.55		S., 8	S	S., 8	Steady.
West O'Rowa, Am. S. S.	Otaru	San Pedro	46 00 N.	153 00 E.	2	Noon, 3	4	29.10	SE	NE., 3	N	NNW., 8	SSE.-NE.-NW.
West Hixton, Am. S. S.	Portland	Nagoya	50 00 N.	134 00 W.	5	1 p., 5	7	29.33	WSW	SSW., —	NW	WNW., 8	SSE.-NW.
Meton, Am. S. S.	Cebu	Portland	18 03 N.	131 31 E.	6	9 p., 6	7	28.93	NW	WSW., 12	SE	WSW., 12	W.-SW.
West Holbrook, Am. S. S	Yokohama	do	50 42 N.	149 22 W.	6	Noon, 8	8	30.10	W	NW., 7	NNW	NW., 9	W.-NW.
Frank G. Drum, Am. S. S.	San Pedro	Honolulu	33 15 N.	121 07 W.	7	8 a., 7	8	29.83	W	NW., 6	N	—, 8	W.-N.
China Arrow, Am. S. S.	Taku Bar	San Francisco	48 54 N.	168 30 E.	7	7 a., 8	8		S	S., 9	S	S., 10	Steady.
Africa Maru, Jap. S. S.	Yokohama	Victoria	46 56 N.	160 38 E.	7	Noon, 7	8	29.50	S	SSE., 8	WNW	SSE., 10	S.-SSE.
Levant Arrow, Am. S. S.	Hongkong	San Francisco	38 42 N.	133 10 W.	8	4 p., 8	8	29.42	WNW	W., 9	W	W., 10	WNW.-W.
City of Vancouver, Br. S. S.	Osaka	Victoria	48 36 N.	133 38 W.	8	8 a., 9	9	29.01	NE	ENE., 9	NE	ENE., 9	NE.-ENE.
El Oso, Br. S. S.	Yokohama	Tsingtau	31 22 N.	129 20 E.	8	4 p., 8	9	29.85	NNW	NNE., 8	NE	NE., 9	Steady.
Pres. Monroe, Am. S. S.	San Francisco	Kobe	30 45 N.	152 30 E.	11	7 a., 12	12	29.13	SW	NE., 12	N	NE., 12	SW.-NE.
Korea Maru, Jap. S. S.	do	Yokohama	33 10 N.	152 45 E.	11	1 p., 12	12	29.75	SW	NE., 9	E	NE., 9	
Makiki, Am. S. S.	Bellingham	Honolulu	42 32 N.	136 16 W.	13	3 p., 13	13	29.04	SSE	S., 9	S	S., 9	SSE.-S.
Harold Dollar, Br. S. S.	Taku Bar	San Francisco	44 39 N.	151 00 E.	13	Noon, 14	15	29.10	W	W., —	WNW	NW., 12	W.-WNW.
Las Vegas, Am. S. S.	Columbia Riv.	Japan	51 08 N.	143 05 W.	14	Noon, 14	15	29.68	SE	NNE., 4	NE	NNE., 8	4 pts.
West Hixton, Am. S. S.	Portland	Nagoya	50 00 N.	177 20 E.	16	9 a., 16	17	29.03	SW	SW., 9	SSW	SW., 9	
Iwatesan Maru, Jap. S. S	Yokohama	San Francisco	46 47 N.	151 25 W.	20	4 p., 20	21	28.87	SE	SE., 8	S	SE., 8	SE.-S.
Biyo Maru, Jap. S. S.	Muroran	Vancouver	46 58 N.	179 25 W.	20	Noon, 21	21	28.86	SE	NW., 8	NNW	NW., 8	W.-NW.-N.
West Calera, Am. S. S.	Hongkong	San Francisco	42 42 N.	167 30 W.	20	4 p., 21	23	29.00	SE	WNW., 7	NW	N., 9	
Meton, Am. S. S.	Cebu	Portland	44 52 N.	167 45 W.	21	1 p., 21	23	28.88	NE	ENE., 5	WNW	NW., 9	N.-NW.
Harold Dollar, Br. S. S.	Taku Bar	San Francisco	48 47 N.	156 15 W.	22	1 p., 23	23	28.55	N	NW., 9	NW	NW., 9	NNW.-NW.
Makena, Am. S. S.	Port Angeles	Honolulu	36 50 N.	142 40 W.	21	4 p., 22	24	29.41	SE	SW., 8	W	SW., 10	
Las Vegas, Am. S. S.	Columbia Riv.	Japan	51 10 N.	177 15 W.	23	2 p., 23	24	29.50	WNW	W., 4	WNW	WNW., 10	Steady.
Do	do	do	46 00 N.	154 30 E.	27	9 p., 27	28	29.12	NW	NW., 9	NNW	NW., 10	Steady.
Pres. Harrison, Am. S. S.	San Francisco	Kobe	31 17 N.	153 39 E.	26	1 a., 27	27	29.82	SSW	SSW., 6	SW	SSW., 9	SSW.-SW.
Santa Cecilia, Am. S. S.	do	Providence	14 57 N.	96 04 W.	27	Noon, 27	27	29.79	NE	NE., 9	NNE	NE., 10	Steady.
Lurline, Am. S. S.	Seattle	Honolulu	38 05 N.	141 55 W.	27	7 p., 27	28	29.58	SE	SE., 8	S	SE., 8	SE.-S.
Wheatland Montana, Am. S. S.	Orient	Seattle	45 55 N.	160 15 E.	27	—, 29	30	29.00	NW	NW., 9	NW	NW., 10	Steady.
Gyokoh Maru, Jap. S. S.	Osaka	Coos Bay	49 30 N.	152 40 W.	29	1 a., 29	30	29.15	S	SE., 8	S	SE., 8	Steady.
SOUTH ATLANTIC OCEAN													
California, Dan. S. S.	Rotterdam	Buenos Aires	25 14 S.	43 00 W.	15	8 a., 15	17	29.72	NE	NE., 7	SW	SW., 9	NE.-SW.

NORTH PACIFIC OCEAN

By Willis E. Hurd

The Aleutian low deepened rapidly in October, and was this month central along the eastern Aleutian chain and the northwestern part of the Gulf of Alaska, the lowest average pressure being 29.44 inches, at Kodiak. Over the area from Juneau to Dutch Harbor pressures were below normal by 0.13 to 0.21 inch. Under the influence of the cyclone abnormally heavy rains for the month occurred over a great region along the coast from Alaska to central California and thence southwestward to the Hawaiian Islands. At Honolulu 1.61 inches of rain fell from the 23d to the 25th, inclusive, and was directly traceable to the "widespread Aleutian low" on those dates, according to the official there. At Juneau, in addition to great rainfall, there were nearly 4 inches of snow. Along the northern steamer routes rain squalls were frequent and hail fell on several days.

The North Pacific high was fairly stable during the first decade of October, but thereafter was much weaker and more variable in position, at times being displaced almost completely by the northern low. Throughout its whole average area, from the California coast to Midway Island, pressures were slightly below normal.

The following table indicates the barometric conditions:

Table 1.—*Averages, departures, and extremes of atmospheric pressure at sea level at indicated hours, North Pacific Ocean, October, 1926*

Station	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Inches	Inch	Inches		Inches	
Dutch Harbor [1]	29.48	−0.21	30.42	8th	28.66	18th.
St. Paul [1, 2]	29.61	−0.05	30.40	7th	28.80	21st.
Kodiak [1, 2]	29.44	−0.15	30.14	8th	28.50	23d.
Midway Island [1]	30.01	−0.04	30.16	24th	29.88	28th.
Honolulu [3]	29.96	−0.04	30.06	16th	29.80	10th.
Juneau [3]	29.74	−0.13	30.42	28th	29.12	15th.
Tatoosh Island [3, 4]	29.97	−0.06	30.37	28th	29.35	9th.
San Francisco [3, 4]	29.97	−0.03	30.20	24th	29.73	8th.
San Diego [3, 4]	29.91	−0.02	30.05	15th	29.58	7th.

[1] P. m. observations only.
[2] 30 days.
[3] A. m. and p. m. observations.
[4] Corrected to 24-hour mean.

Over most of the ocean there was a slight decrease in fog, but a general and considerable increase in the number and force of gales. Fog, however, showed a decided increase along the American coast from Vancouver to the upper part of the Peninsula of California, and particularly between North Head and San Diego, where available reports indicate its occurrence on more than 50 per cent of the days.

Gales were frequent along the northern routes, in some part of which they occurred daily, and over the middle part of the route between Honolulu and Puget Sound.

In the latter area they were noted on 9 or 10 days, blowing from southwest, south, southeast, and northeast, of forces varying from 8 to 10. No forces higher than 10 were reported east of the 160th meridian of east longitude, but west of it full hurricane velocities were encountered by steamers on several days, the result of typhoons active in the waters of the Far East during the early half of the month. Our only knowledge of these storms at this writing is gathered from the few reports at hand of vessels traversing this region, since the summary of typhoons from the Philippine Weather Bureau has not been received. These reports indicate 3 and probably 4 violent storms.

On October 2 and 3 the American steamer *President Lincoln*, while some 600 miles east of Yokohama, ran into a typhoon and encountered hurricane winds from the southwest. The vessel must have crossed the storm near its center, since the observed pressure went as low as 28.45 inches. On the 6th and 7th an equally severe storm was experienced about 300 miles east-northeast of Luzon by the American steamer *Meton*, eastward bound from the Philippines. The lowest pressure observed was 28.93 inches, near 18° N., 131½° E. On the 11th and 12th the Dollar Line steamship *President Monroe*, toward Kobe, ran into a typhoon near 31° N., 152½° E. The hurricane winds were from the northeast, lowest pressure 29.13 inches. On the 13th the British steamer *Harold Dollar*, bound for San Francisco, fell in with rough weather while among the Kuril Islands. The westerly gales increased to hurricane force on the 14th and 15th, and the lowest pressure, 29.10 inches, occurred on the 14th, while the vessel was in 44° 39′ N., 151° E.

One tropical cyclone, probably of no great strength, occurred in the waters off the coast of Mexico, first appearing south of Acapulco on the 2d. By the 3d it had developed sufficient energy to cause winds of gale force, as shown by the report of the American steamer *William Penn*, which encountered a south wind of force 8, pressure 29.55, in 14° 05′ N., 104° 21′ W. It is not known if gales attended the subsequent movements of the cyclone, but according to the Mexican weather reports it lay off the coast, apparently between Acapulco and the western part of the Gulf of Tehuantepec until the 11th, when it disappeared.

Moderate northers blew in the Gulf of Tehuantepec on the 26th and 27th.

At Honolulu the prevailing wind was from the northeast, but there were a greater number of winds than usual from other directions. Velocities exceeding 24 miles occurred on 5 days, the maximum being 31 from the east on the 17th. The total precipitation was 1.93 inches, which is 0.38 inch more than the normal.

DETAILS OF THE WEATHER IN THE UNITED STATES

GENERAL CONDITIONS

The month as a whole did not depart widely from a normal October. The heavy rains of the previous month in middle Mississippi Valley States continued throughout the first week of October over a broad band stretching from the Texas Panhandle, Oklahoma, and Arkansas northeastward to the Great Lakes.

The month was warm with the exception of northeastern States where atmospheric pressure was higher than the normal and considerably above that for the previous months. The usual details follow.—*A. J. H.*

CYCLONES AND ANTICYCLONES

By W. P. DAY

The tracks of 20 low-pressure areas were plotted during October, an increase of 3 over the preceding month; and storm movement across the United States was comparatively rapid. However, over the northeastern Pacific Ocean there were several major depressions, which were unusually slow in movement. Two tropical disturbances developed during the month, one of which, passing over west-central Cuba and Bermuda, developed great intensity and apparently retained its identity far out into the Atlantic.

The HIGHS were mostly of the Pacific type. Although high-pressure prevailed over the Mackenzie Valley from the 8th until the 16th and again toward the end of the month, the HIGHS from this region were weak, since they were usually coincident with rising pressure moving in from the Pacific, with which they coalesced.

FREE-AIR SUMMARY

By L. T. SAMUELS

Free-air temperatures were in general below their normal values at the northern stations and above at the southern stations. (See Table 1.) The departures at the latter decreased with increase in altitude while those at the northern stations increased in general with altitude.

Relative humidity and vapor pressure departures were mostly positive, those for the former being small while those for the latter were moderate.

It will be seen in Table 2 that the resultant winds at Due West were practically diametrically opposite to their normals, a marked southerly component occurring instead of the usual one from the north. At this station the greatest excess in the mean monthly temperatures was found.

A kite flight of more than ordinary interest was obtained at Broken Arrow on the 4th just as a wind shift line passed over the station. The following tabulation shows the temperatures and upper and lower wind directions recorded during the ascent and descent of this flight. It will be seen that the surface wind shifted from southerly to northerly during the ascent while the wind aloft remained southerly. Further, this lower northerly current became successively deeper during the flight. The surface temperature dropped immediately with the arrival of the northerly current but the dissipation of the cloud layer which accompanied the shift soon caused the temperature to rise again in its ordinary diurnal march. The steadily increasing effect of this surface warming is well brought out in the table by the relatively higher temperatures from the ground to 1,000 m. during the descent of the flight than during the ascent. It will be noted, however, that the temperatures at 2,000 m. and 2,500 m. were *lower* during the descent than during the ascent *notwithstanding the continuance of the southerly winds* at these levels. This cooling within the southerly current was evidently the result of its forced ascent by the underrunning northerly current. This explanation is further strengthened by the fact that at 3,000 m. an appreciable warming instead of cooling occurred, apparently because the air at this higher level had not yet been forced upward. While the air in its forced ascent cooled to some extent by reason of its expansion yet the absolute humidity was too low to cause condensation.

Altitude (m.) M. S. L.	Ascent 7:16 to 9:20 a. m.		Descent 10:40 a.m. to 12:02 p. m.	
	° C.	Aloft/Surf.	° C.	Aloft/Surf.
233	17.8	SW./SW	19.6	N./N.
500	16.1	WSW./SW	16.6	NNW./N.
1,000	13.0	W./WSW	13.3	WNW./N.
1,500	11.0	WSW./WNW	11.0	WSW./NNW.
2,000	11.2	SW./NNW	10.6	SSW./NNW.
2,500	7.2	SW./NNW	6.8	SSW./NNW.
3,000	2.8	SW./NNW	4.5	SW./NNW.

A kite flight made at Royal Center on the 5th was in progress when precipitation began at that station. A significant feature shown by this record was a fall in temperature at the upper levels from the time of the ascent to the descent. The effect of this decrease in temperature resulted in convection and subsequent condensation as evidenced in the moist-air adiabatic lapse rate found. The wind direction was WSW. at all elevations but became W. at the surface about a half hour before the end of the flight. The observation was made in the southern quadrant of a strong area of low pressure. The temperatures are shown in the following table:

Altitude (m.) M. S. L.	Ascent 2:01 to 2:54 p. m.	Descent 3:15 to 4:05 p. m.
	° *C.*	° *C.*
225	15.3	13.7
500	12.0	10.9
1,000	8.5	7.4
1,500	5.3	4.0
2,000	2.0	1.4
2,500	−0.5	−1.9

An illustration of a warm southerly current overrunning a relatively colder one from the NE. and subsequent precipitation is afforded by the Due West kite and pilot balloon records of the 16th. The lower northeasterly winds were the result of a high pressure area to the northeast of the station, while the upper southerly winds were caused by the indraft of a strong Low to the northwest. A layer of St. Cu clouds at an elevation of about 2,000 m. limited the height of the balloon observation, while the continued rain caused the kites to collapse after a maximum altitude of nearly 1,800 m. was attained.

Table 1.—*Free-air temperatures, relative humidities, and vapor pressures during October, 1926.*

TEMPERATURE (°C.)

Altitude (m.) m. s. l.	Broken Arrow, Okla. (233*m.*)		Due West, S. C. (217*m.*)		Ellendale, N. Dak. (444*m.*)		Groesbeck, Tex. (141*m.*)		Royal Center, Ind. (225*m.*)		Washington, D. C.[1] (7*m.*) (mean)
	Mean	Departure from 9-yr. mean	Mean	Departure from 6-yr. mean	Mean	Departure from 9-yr. mean	Mean	Departure from 9-yr. mean	Mean	Departure from 9-yr. mean	
Surface	18.0	+1.4	18.3	+2.0	7.2	+0.1	21.1	+2.3	11.9	−1.1	13.3
250	17.9	+1.4	17.9	+1.9	------	------	20.4	+1.8	11.7	−1.1	12.5
500	16.4	+1.1	16.5	+2.3	7.2	0.0	18.9	+1.3	10.2	−1.2	11.7
750	15.2	+0.9	15.0	+2.1	6.7	−0.4	17.8	+1.3	8.7	−1.3	10.8
1,000	14.7	+1.4	13.8	+2.0	6.0	−0.4	16.8	+1.4	7.7	−1.1	9.5
1,250	13.8	+1.4	12.4	+1.7	5.1	−0.5	16.2	+1.7	6.7	−0.9	8.2
1,500	12.5	+1.1	11.4	+1.7	4.3	−0.4	15.2	+1.8	5.3	−1.2	7.2
2,000	9.9	+0.6	9.9	+1.9	1.9	−0.6	12.9	+1.7	2.6	−1.5	5.5
2,500	7.0	+0.2	7.4	+1.1	−0.9	−0.9	10.8	+1.9	0.2	−1.6	3.4
3,000	4.4	+0.3	4.5	+0.5	−4.4	−1.7	7.9	+1.3	−2.3	−1.6	1.1
3,500	1.5	+0.2	1.6	+0.3	−7.8	−2.3	4.2	−0.1	−4.5	−1.4	−1.5
4,000	−0.8	+0.6	−1.5	+0.1	−11.2	−2.9	1.6	−0.1	−6.7	−1.4	−3.9
4,500	−3.9	+0.1	−4.3	0.0	------	------	------	------	------	------	------

RELATIVE HUMIDITY (%)

Altitude (m.) m. s. l.	Broken Arrow Mean	Departure	Due West Mean	Departure	Ellendale Mean	Departure	Groesbeck Mean	Departure	Royal Center Mean	Departure	Washington
Surface	68	+1	67	+4	75	+6	70	−3	76	+8	79
250	68	+1	67	+4	------	------	70	−1	76	+8	74
500	64	0	65	+2	72	+5	71	+3	73	+7	71
750	62	−1	64	+1	67	+5	68	+1	74	+9	72
1,000	59	−2	63	+1	64	+4	63	−2	71	+7	74
1,250	56	−3	61	0	62	+4	57	−5	70	+9	76
1,500	55	−2	56	−2	59	+4	58	−2	70	+12	76
2,000	53	+1	48	−3	59	+7	53	−1	69	+16	69
2,500	52	+4	47	+2	59	+9	45	−4	61	+12	65
3,000	46	+2	45	+2	60	+12	43	0	59	+12	60
3,500	37	−5	43	+2	65	+17	42	+2	53	+9	55
4,000	22	−15	49	+8	78	+31	47	+8	43	+5	51
4,500	20	−11	50	+10	------	------	------	------	------	------	------

VAPOR PRESSURE (*mb.*)

Altitude (m.) m. s. l.	Broken Arrow Mean	Departure	Due West Mean	Departure	Ellendale Mean	Departure	Groesbeck Mean	Departure	Royal Center Mean	Departure	Washington
Surface	14.61	+1.69	14.88	+2.65	7.71	+0.72	17.89	+1.38	11.45	+0.89	12.80
250	14.48	+1.66	14.58	+2.54	------	------	17.41	+1.52	11.34	+0.90	11.42
500	12.71	+1.18	13.08	+2.24	7.44	+0.56	16.30	+1.89	10.12	+0.90	10.46
750	11.42	+0.91	11.76	+1.81	6.53	+0.15	14.76	+1.45	9.30	+0.99	10.13
1,000	10.52	+0.88	10.59	+1.41	5.79	−0.05	12.76	+0.68	8.25	+0.72	9.68
1,250	9.42	+0.65	9.46	+1.18	5.17	−0.12	10.80	0.00	7.49	+0.78	9.16
1,500	8.63	+0.71	8.28	+0.97	4.63	−0.12	10.00	+0.31	6.89	+0.97	8.51
2,000	7.03	+0.95	6.49	+0.92	4.07	+0.20	7.69	+0.37	5.91	+1.26	6.82
2,500	5.64	+0.98	5.44	+1.14	3.34	+0.19	5.55	−0.13	4.81	+1.13	5.48
3,000	4.14	+0.61	4.49	+1.00	2.68	+0.15	4.35	+0.08	3.98	+0.95	4.13
3,500	2.47	−0.15	3.59	+0.78	2.36	+0.28	3.58	+0.21	3.36	+0.91	2.83
4,000	0.86	−0.94	3.42	+0.96	2.27	+0.61	3.53	+0.72	2.77	+0.94	1.87
4,500	0.16	−1.11	3.14	+0.90	------	------	------	------	------	------	------

[1] Naval Air Station.

Table 2.—*Free-air resultant winds (m. p. s.) during October, 1926*

Altitude, (m.) m. s. l.	Broken Arrow, Okla. (233 meters)				Due West, S. C. (217 meters)				Ellendale, N. Dak. (444 meters)				Groesbeck, Tex. (141 meters)				Royal Center, Ind. (225 meters)				Washington, D. C. (34 meters), (mean)	
	Mean		9-year mean		Mean		6-year mean		Mean		9-year mean		Mean		9-year mean		Mean		9-year mean			
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Meters																						
Surface	S. 12°W.	3.0	S. 3°E.	2.2	S. 61°W.	0.7	N.47°E.	1.8	N.67°W.	2.8	N.70°W.	1.8	S. 3°E.	1.8	S. 66°E.	0.8	S. 57°W.	2.4	S. 48°W.	2.3	N.71°W.	0.6
250	S. 13°W.	3.1	S. 2°E.	2.3	S. 61°W.	0.7	N.45°E.	1.8	------	----	------	----	S. 2°E.	2.4	S. 42°E.	1.3	S. 59°W.	2.9	S. 48°W.	2.6	N.84°W.	2.3
500	S. 21°W.	4.5	S. 5°W.	3.4	S. 72°W.	1.9	N 48°E.	2.3	N.78°W.	2.9	N.78°W.	2.0	S. 3°W.	3.6	S. 23°E.	2.5	S. 75°W.	5.9	S. 56°W.	4.7	W.	3.7
750	S. 30°W.	4.7	S. 14°W.	4.1	S. 79°W.	3.2	N.51°E.	1.9	N.88°W.	5.0	N.88°W.	2.9	S. 12°E.	4.0	S. 14°E.	2.9	S. 81°W.	7.7	S. 65°W.	6.0	N.87°W.	5.1
1,000	S. 40°W.	5.0	S. 24°W.	4.2	S. 79°W.	4.6	N.32°E.	0.9	N.79°W.	6.5	N.85°W.	3.6	S. 20°W.	3.7	S.	2.9	S. 83°W.	8.9	S. 71°W.	6.6	N.86°W.	5.8
1,250	S. 60°W.	6.4	S. 38°W.	4.3	S. 81°W.	6.1	N.39°W.	0.8	N.74°W.	8.1	N.82°W.	4.4	S. 41°W.	4.3	S. 12°W.	3.0	S. 79°W.	10.6	S. 74°W.	7.6	------	----
1,500	S. 69°W.	7.0	S. 46°W.	4.6	S. 79°W.	8.1	N.83°W.	1.6	N.73°W.	9.5	N.83°W.	5.2	S. 51°W.	4.0	S. 25°W.	2.9	S. 86°W.	10.4	S. 79°W.	8.2	N.77°W.	8.0
2,000	S. 78°W.	7.2	S. 56°W.	4.9	S. 79°W.	9.8	N.86°W.	2.6	N.73°W.	10.7	N.81°W.	6.6	S. 50°W.	4.6	S. 45°W.	3.0	S. 89°W.	12.5	S. 82°W.	9.6	N.78°W.	8.5
2,500	S. 87°W.	8.3	S. 70°W.	5.4	S. 80°W.	10.5	N.83°W.	4.9	N.70°W.	12.2	N.77°W.	8.1	S. 61°W.	5.0	S. 54°W.	3.5	N.81°W.	13.3	S. 87°W.	10.4	N.77°W.	11.1
3,000	S. 68°W.	8.1	S. 70°W.	6.6	S. 83°W.	11.3	W.	6.0	N.71°W.	12.5	N.80°W.	9.3	S. 83°W.	5.0	S. 61°W.	3.9	N.79°W.	15.3	N.89°W.	11.5	N.82°W.	13.0
3,500	S. 74°W.	9.4	S. 77°W.	7.8	S. 71°W.	10.5	N.88°W.	7.2	S. 83°W.	13.3	N.83°W.	11.0	N.76°W.	4.7	S. 58°W.	4.0	N.79°W.	18.2	S. 88°W.	13.6	N.74°W.	12.4
4,000	S. 80°W.	8.2	S. 70°W.	8.5	S. 76°W.	8.4	S. 84°W.	6.8	S. 80°W.	15.7	N.88°W.	11.8	S. 88°W.	4.9	S. 50°W.	3.9	N.64°W.	20.8	N.88°W.	13.3	N.71°W.	13.0
4,500	S. 73°W.	9.5	S. 76°W.	9.0	S. 22°W.	11.0	N.83°W.	5.2	N.74°W.	18.1	S. 84°W.	13.5	N.67°W.	5.0	S. 62°W.	2.7	------	----	------	----	------	----
5,000	W.	12.0	S. 73°W.	10.0	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----

THE WEATHER ELEMENTS

By P. C. DAY, In Charge of Division

PRESSURE AND WINDS

Unlike the preceding month, October weather was without important variations from that usually experienced in the mid-autumn month. Frequent and heavy rains over the central valleys, which had been such a marked feature of the weather during September, continued into the first week of October, but at the end of that time precipitation became more infrequent and the remainder of the month was mainly comparatively dry in that region. A tropical storm of great severity, moving northward through western Cuba on the morning of the 20th, attended by important loss of life and great damage to property on the Isle of Pines and over western Cuba, including the vicinity of Habana, seriously threatened the section of southern Florida visited by the disastrous hurricane of September. Fortunately this storm changed its course slightly to the northeastward and southern Florida escaped serious loss although rather high winds prevailed at Miami and in nearby areas.

The month opened with moderate to heavy precipitation over a large area from the northern Rocky Mountains eastward to the upper Lakes and lower Ohio Valley, the rain area extending northward into the western Canadian Provinces. This was promptly followed by a low-pressure area that developed over the middle Plains on the 3d and moved during the following 24 hours to Lake Superior, attended by heavy rains in portions of the Great Plains and upper Mississippi Valley, continuing during the following few days over the Ohio Valley and to the eastward, while lighter falls occurred over nearly all other districts from the Mississippi River eastward. In amount of rainfall and area covered this was the most important storm of the month.

From the 7th to the end of the second decade no cyclone of importance passed over the country, though local rains occurred at intervals; but these were mainly light and covered comparatively small areas.

On the 20th a tropical storm approached southern Florida and heavy rains set in over that area, the 24-hour falls amounting to from 5 to nearly 10 inches at points near the coast from Key West to Miami.

About the 22d cyclonic conditions developed over the far Southwest and during the 23d to 25th moved northeastward to the Ohio Valley and New England as a storm of considerable importance, attended by precipitation over nearly all districts from the eastern Great Plains to the Atlantic coast, the falls being quite heavy in portions of the Ohio and lower Mississippi Valleys and the North Atlantic States. No important cyclones occurred from the 25th to the end of the month, though there were local showers at intervals over rather wide areas from the Mississippi Valley eastward. Over the far Western States there were few important storms, and precipitation was confined largely to the coast districts where it occurred rather frequently during the first half of the month.

The anticyclones of the month were usually well pronounced, but entered the United States mainly through the Pacific Coast States and hence were associated with only moderate temperatures.

Probably the most important anticyclone entered the far West on the morning of the 3d and moved slowly eastward, reaching the central valleys by the 6th and the Southeastern States by the 8th, where it remained more or less fixed until after the end of the first decade, or until reinforced by another that had followed a somewhat similar course from the Middle Plateau and reached the eastern districts by the middle of the month.

Another anticyclone that dominated the weather for a considerable period over the more southern districts entered the middle Pacific coast districts on the 23d, held sway over the Plateau on the following day, and advanced successively into the southern Plains and Southeastern States where it remained with diminishing intensity until near the close of the month.

The average pressure was highest over an extensive area from the far Northwest southeastward to the East Gulf and South Atlantic States, with a rather marked depression from the upper Mississippi Valley eastward to New England and the St. Lawrence Valley.

Pressure averages were above normal over a small area in the Plateau States, but otherwise they were below and distinctly so from the Missouri Valley eastward to New England and generally over Canada so far as available observations disclose.

Compared with the preceding month average pressures were higher from the Rocky Mountains westward, and generally over the middle and southern Plains and west Gulf States; elsewhere they were lower, and decidedly so over the southern districts of Canada and from the upper Mississippi Valley to New England.

The pressure distribution was not sufficiently marked to produce a persistent influence on the wind circulation, so that no large areas had prevailing winds from a single direction, but they were mainly from southerly points in the west Gulf and middle Plains and in portions of the Ohio Valley and to the Northeast, while westerly to northerly winds were frequent in the upper Missouri Valley and thence easterly to the Great Lakes.

Local high winds were infrequent and important damage was confined mainly to small areas, but few lives being lost. The details of severe wind and other damaging storms appear at the end of this section.

TEMPERATURE

The daily temperature changes were small; only in a few instances did they amount to more than 20°, and these were chiefly confined to small areas. The most notable case of important changes was on the 25th when temperatures were 20° to 30° higher than the preceding day over much of the Rocky Mountain region, 20° or more lower in the east Gulf and South Atlantic States, and 20° to 30° or more warmer in northern New England.

Generally the weather was warmer than normal from the Mississippi River westward, also southward from the Ohio and Potomac Rivers. It was cooler than normal from the upper Mississippi Valley and Manitoba eastward, save for a few localities in the St. Lawrence Valley. Generally there were no extremely high or low temperatures and the month as a whole was in marked contrast with October of 1925, when the lowest temperatures ever experienced in October were reported from nearly all northern and central sections from the Rocky Mountains eastward, and the monthly means were likewise the lowest ever observed over much of the same area.

The continued coolness over the northeastern district added another to the already long list of months with temperature averages there materially below normal.

The important warm periods were the first few days over practically all districts from the Mississippi Valley eastward, beginning on the 1st or 2d in the western districts and continuing to the 3d or 4th over the Atlantic Coast States. Over much of the country from the Great Plains westward the warmest periods were on the 4th and 5th in the far Northwest, and from the 15th to 17th over most other sections.

The lowest temperatures were observed mainly from the 25th to 28th from the middle and lower Mississippi Valley eastward, while from the Great Plains westward they were experienced chiefly from the 29th to 31st. Temperatures of 32° or lower were observed in all the States, though considerable areas in the Gulf and South Atlantic States and the lower elevations of the Southwest and California were without freezing temperatures. The lowest observed was −10°, at a high elevation in Colorado.

Frosts, save those of late September in the more northern districts, were mainly delayed until well after the average date, and most crops not injured at that time matured without injury from cold.

PRECIPITATION

The distribution of rainfall was, in a measure, similar to that of September as to comparison with the normal, there being an excess over a large area from the southern Plains northeastward through the middle Mississippi and Ohio Valleys, and generally over the Great Lakes area and to the eastward, as was the case in September, though the excesses were usually much less than in that month. Also the Middle and East Gulf and South Atlantic States had less than normal and this was also the case in September.

In general it was a month with precipitation above normal over a large majority of the States, though the total fall was distinctly less than was received in September.

In a few instances, notably in the vicinity of Lake Erie, and over the eastern portions of Kansas and Oklahoma and in western Arkansas, it was the wettest or nearly the wettest October of record. On the other hand, it was among the driest in the middle portions of the Plateau.

Continued rains over many portions of the central valleys and to the eastward during the first week still further delayed farming operations and caused additional damage to crops not yet gathered, by flooding or otherwise.

SNOWFALL

No important or unusual falls of snow were reported, which is in sharp contrast with conditions existing in October, 1925, when over large areas the snowfall occurred earlier and to greater depths than ever before recorded in the mid-autumn month.

Depths up to 10 inches or slightly more occurred in the mountains of northern New York and somewhat less fell in the interior and northern portions of New England. In the upper Lake region and thence to eastern North Dakota the total depths ranged up to 5 inches, and in a few localities up to 10 inches. In the Rocky Mountains there was more or less snow, extreme depths at some of the higher levels ranging up to 10 inches and in a few instances to as much as 15 inches or slightly more.

There was little snow over the northern mountain districts or in the Plateau and Pacific Coast States, save in the high Sierra of central California where a few localities had total falls ranging up to 5 or 10 inches. Little snow remained on the ground at the end of the month save in the mountain districts.

RELATIVE HUMIDITY

The percentage of relative humidity was above normal to a considerable extent in the far Southwest and over most of the areas to the northeastward and eastward, save along the Atlantic and Gulf coast districts where there were mainly small deficiencies. Over the Missouri Valley and thence west to the Pacific relative humidity was generally less than normal.

SEVERE LOCAL HAIL AND WIND STORMS, OCTOBER, 1926

[The table herewith contains such data as have been received concerning severe local storms that occurred during the month. A more complete statement will appear in the Annual Report of the Chief of Bureau]

Place	Date	Time	Width of path, yards [1]	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Humboldt, Iowa	1	1 a. m.				Probably a tornado.	Dwellings, garages, and plate-glass windows damaged to the extent of several thousand dollars.	Official, U. S. Weather Bureau.
Independence, Kans.	1	3:30–4 p.m.	4 mi.		$1,500	Hail	Damage chiefly to cotton crop and window glass. Path 4 miles long.	Do.
Sandusky County, Ohio	1	P. m.				Violent wind and rain.	Trees uprooted; buildings damaged; telephone and telegraph lines blown down; many orchards badly injured; car service interrupted.	Do.
Dawson County, Tex. (southwest part of).	2	7 p. m.	3 mi.			Straight winds	Several windmills and weak buildings wrecked; cotton blown out. Path 15 miles long.	Do.
Cloverport, Ky	4					Wind	Character of damage not reported	Do.
Lansing (near), Mich	4					Tornadic wind	Damage to trees, buildings, and fences resulted	Do.
Willet, N. Y	5					High wind	Windows, trees, and overhead wires considerably damaged.	Do.
Harpersfield Center, N. Y	5	Midnight				Tornadic wind	Several homes damaged; highways obstructed by fallen trees.	Official, U. S. Weather Bureau; Star (Oneonta, N. Y.)
Kingsley and Hopbottom, Pa., and vicinity.	6					Cloudburst and wind.	Extensive damage to farms, roads, and buildings, principally by flooding.	Scranton Times (Pa.).
Wanamaker, Kans	12	A. m.				Heavy hail and rain.	Total damage small, as most crops had matured.	Official, U. S. Weather Bureau.
Key West, Fla	20-21				20,000	High wind and rain.	Considerable property damage reported	Do.
Chandler, Okla., and vicinity.	22	Noon	7 mi.		3,000	Moderate to heavy hail.	Some damage to property and minor crop injury over path 8 miles long.	Do.
Okmulgee County, Okla., (southern part of).	22	3–4 p. m.	6 mi.		7,000	Light to heavy hail.	Crops considerably damaged; other losses slight. Path 20 miles long.	Do.
Shiner, Tex	23	2:20 – 2:55 p. m.	5 mi.		15,000	Heavy hail	Windows, roofs, and crops seriously damaged; poultry killed or injured; stones weighed from 3 to 8 pounds.	Do.
Rosenberg, Richmond, Sugarland, and Missouri City, Tex.	23	3:30–4 p. m.			100,000	do	Cotton stripped, cattle severely injured, and windows broken.	Do.
Wortham, Tex	23					Hail and wind	Windows and roofs damaged; several oil derricks wrecked, one burned by lightning.	Do.
Philadelphia, Pa	25					High wind and rain.	Considerable minor damage	Do.
New Jersey (northern and central parts of).	25					Severe winds and heavy rains.	Much damage to buildings, poles, trees, and signs at various points.	Do.
New York City, N. Y	25					High wind	A 74-mile wind damaged many windows and paralyzed harbor traffic.	Official, U. S. Weather Bureau; Star (Oneonta, N. Y.)
Irvington-on-Hudson, N. Y	25			2		do	A steam freighter capsized, causing death of two persons.	Official, U. S. Weather Bureau.

[1] "Mi." signifies miles instead of yards.

STORMS AND WEATHER WARNINGS

WASHINGTON FORECAST DISTRICT

A tropical disturbance of slight and diminishing intensity passed on a west-northwest course from about latitude 20°, longitude 61°, on September 26, to latitude 25°, longitude 71°, on October 1. Advices were disseminated twice daily, but they were rather indefinite as to its location on account of lack of vessel reports.

A second disturbance also of slight intensity was located south of Swan Island on the morning of the 3d. It advanced slowly northwestward and was last susceptible of identification on the evening of the 4th off the coast of British Honduras. The highest wind velocity reported in connection with this disturbance was 42 miles per hour, by the S. S. *Toloa* at 1 a. m. of the 3d in latitude 18° 10′, longitude 82° 40′, approximately.

Another tropical disturbance of slight intensity apparently developed northeast of Turks Island during the 14th–15th and moved slowly northward until the morning of the 16th, when it was central, as near as can be estimated, in latitude 27°, longitude 69°. The S. S. *San Lorenzo* reported a barometer of 29.60, wind west 28 miles on the evening of the 15th in approximate latitude 25° 30′, longitude 68° 30′. It then turned eastward and southeastward, but absence of vessel reports prevents tracing its subsequent course. Advices were broadcast twice daily.

Beginning on the 14th and continuing for several days pressure fell slowly over the southwestern Caribbean and Canal Zone region. From reports now available it would seem that a cyclonic circulation existed as early as the 16th, but sufficiently definite information was not available until the evening of the 17th to broadcast information that a tropical disturbance of slight intensity was central about 300 miles north of Colon. The disturbance moved north-northwestward with rapidly increasing intensity, passing near and to the east of Swan Island during the night of the 18th–19th.

The S. S. *Pastores* at 3 p. m. of the 17th, in approximate latitude 14° 20′, longitude 81° 30′, recorded a barometer of 29.42 and north winds of 28 miles per hour with steady rain. At 10 a. m. of the 18th the S. S. *Atenas*, in approximate latitude 16° 30′, longitude 82°, had a barometer of 29.26 inches north, raining, 50 miles, and at noon in nearly the same position reported a barometer of 28.74 north, cloudy and light wind, being apparently at the center of the storm. The lowest barometer 24 hours previous was about 29.40, indicating a decrease of pressure of 0.66 in that time. During the daylight hours of the 19th the center moved almost due north and during the next 12 hours northeast, passing over Nueva Gerona, on the Isle of Pines at 3 a. m., when a calm lasting 30 minutes was noted. Storm warnings were ordered for Key West at midnight of the 19th–20th, and on the following morning hurricane warnings were displayed along the southern Florida coast from Punta Rassa and Punta Gorda to West Palm Beach and storm warnings on the west coast northward to Tampa and on the east coast northward to Titusville. At that time the disturbance was central slightly south of Habana. It then moved on a course about east-northeast, passing over the northern Bahamas during the night of the 20th–21st and over the Bermudas about noon of the 22d.

The barometer at Habana was 713 mm. (28.07 inches) at 11:10 a. m. of the 20th, taking the mean of the oscillations of the barograph. The lowest swing during a furious gust was 700 mm. (27.56 inches). The barometer fell from 727 to 700 mm. in about half an hour, a fall of about 1 inch. Rainfall at Habana during the 20th was 510 mm. (20.08 inches). Damage was enormous in the Isle of Pines and in the Province of Habana. A wind velocity of 99 miles per hour was recorded at Habana up to the time that the tower on which the anemometers were exposed was blown down, and was much higher later.

A maximum velocity of 62 miles per hour from the north was recorded at Key West, with gusts estimated at 80 to 85 miles per hour. At Miami winds reached gale force with an estimated velocity of 70 miles per hour from the north-northeast. While there was some damage on the southeast and extreme southern Florida coast, it was not severe, as the storm center passed some 30 miles off the coast. The lowest barometer at Key West was 29.18 inches at 4:14 p. m. of the 20th. At Miami it was 29.22 at 12:40 a. m. of the 21st. The hurricane passed over Bermuda during the day of the 22d. Hamilton reported lowest barometer 28.45 at 11:45 a. m., with central calm lasting about an hour, and highest wind velocity of 128 miles per hour, northwest. At Prospect the lowest barometer was 28.58 and highest wind velocity 114 miles per hour from northwest. The central calm was experienced; the wind velocity from 11:45 a. m. to noon was only 8 miles per hour, whereas from 10:30 a. m. to 11:30 it was 47 and from 12:30 to 1:30 p. m. it was 114.

At St. Georges the lowest barometer was 28.67 inches between 12:30 and 12:52 p. m., The central calm was also experienced here between 12 and 12:52 p. m.

Advices were disseminated at least twice daily concerning the storm, and special advices were sent to the Bahama Islands and to Bermuda. (See account of this hurricane in Bermuda, p. 428 of this REVIEW.)

The rate of progress of the center from the 16th to the 19th was about 200 miles per day; from the 19th a. m. to 20th p. m., about 350 miles per day; and from the 20th p. m. to the 22d p. m., between 600 and 700 miles per day.

On the morning of the 24th storm warnings were ordered from Hatteras to Eastport and small craft warnings south of Hatteras to Jacksonville in connection with a disturbance of increasing intensity over Tennessee. The disturbance moved northeastward with greatly increased intensity and caused gales from Hatteras northward and strong winds of short duration south of Hatteras to Jacksonville.

Frost warnings were issued on the 7th, 8th, 13th, 15th, 17th, 21st, 24th, 25th, and 26th for portions of this district.—*R. H. Weightman.*

CHICAGO FORECAST DISTRICT

There was considerable variation in temperature during the month, the mean temperature being below the seasonal normal from the Mississippi Valley eastward and above normal on the central Great Plains. The greatest excess was 5° at North Platte, Nebr., and the greatest deficiency was 4° at Marquette and Sault Ste. Marie, Mich.

The rainfall was distributed most irregularly, the amounts being large from the Lower Lakes southwestward across the Ohio and Middle Mississippi valleys to southeastern Kansas, while in other portions of the Forecast District the precipitation was either below the seasonal normal or only slightly above.

The disturbances, coming largely from the west and reaching in troughs far to the south, increased consider-

ably in energy in their eastward novement as they approached the Great Lakes, and resulted in more than the usual amount of precipitation in the eastern and southern portions of the region. The relatively low temperature in the Lake region was, moreover, a result of this development, producing as it did, steep gradients and strong northwest winds in the rear of the distrubances. However, there was really no storm of unusual intensity during the entire month. The disturbances were for the most part of moderate energy as they passed across the region. Warnings, either small craft or storm, were displayed on the Great Lakes on various occasions; and frost warnings were issued when conditions warranted over the eastern and southern portions of the Forecast District where vegetation required protection.

The special long-range forecast service for the protection of fruit from the Pacific Northwest in transit through the Dakotas and Minnesota was begun on October 21.—*H. J. Cox.*

NEW ORLEANS FORECAST DISTRICT

The month averaged warm and rainy for the season, although during the last two weeks a number of small, North Pacific HIGHS, attended by cool periods, moved over the district.

The first frosts of the season occurred on the 21st and 24th in the extreme northwestern portion of the district and were in accordance with warnings issued the preceding mornings. The first general frost warning for the northern portion of the district was issued on the 24th. Frost occurred the following morning, not only in the northern portion, but also in interior sections of the extreme southeastern portion. No frosts of importance occurred during the remainder of the month except on the 31st, in the more northern sections of the district, and this was predicted.

No general windstorm occurred. The only storm warnings were issued for the Louisiana coast on the 23d, at 8.30 p. m., because of squally conditions on the Texas coast, which were expected to move eastward with a disturbance from south Texas. The disturbance advanced as expected, but did not cause verifying winds on the Louisiana coast and warnings were lowered the next morning. On the 28th, small craft warnings were displayed on the east and middle coasts of Texas for fresh to strong southerly winds.—*R. A. Dyke.*

DENVER FORECAST DISTRICT

With high barometric pressure predominating over the middle and southeastern portions of the district and the frequent passage of depressions eastward along the Canadian border, the month was unusually mild and precipitation was deficient everywhere except in the northwestern and extreme southeastern portions of Wyoming. There was an almost entire absence of severe weather conditions, so that no general warnings were necessary. Frost and freezing temperature advices, most of which were verified, were issued from time to time for portions of southern Wyoming, western Colorado, and eastern New Mexico.—*E. B. Gittings, jr.*

SAN FRANCISCO FORECAST DISTRICT

On October 4 the depression which had occupied the Gulf of Alaska for several days deepened rapidly and showed signs of moving onto the coast of Washington and British Columbia. Advisory warnings of this probability were consequently sent out to display stations in Oregon and Washington. The disturbance, however, moved northward and diminished in intensity and warnings were not hoisted until the second day after, when they were displayed at all ports from Marshfield north. Southerly gales occurred that day along the coast. On the 8th a new disturbance developed in the Gulf of Alaska and southeast warnings were ordered from Eureka to Cape Flattery in the morning, and extended south to Point Reyes in the evening. Strong winds and gales followed during the night and day after. Timely warnings of rain were sent to all fruit-drying interests in northern California in connection with this disturbance, so that all were enabled to get their fruit under cover.

Conditions began to show a generally disturbed complection over the northeast Pacific on the 9th, and by the 12th a well developed LOW was approaching the Oregon-Washington coast which seemed to require the display of warnings. These were consequently ordered from Cape Blanco north, but were not justified by wind conditions as registered at coast stations, and although gales presumably occurred at sea, the warnings were allowed to expire the day following. However, on the 14th they were displayed again, due to the inward passage of a portion of the ocean LOW over British Columbia, and this time they were followed by strong gales on the coast. The pressure during this period was abnormally low over the greater part of the northeast Pacific, readings in the Gulf of Alaska being below 29.00 inches. Warnings were continued until noon of the 16th, attendant gales subsiding that night.

Another low pressure system of similar character filled the northeast Pacific Ocean during the ensuing week, and on the approach of this disturbance to the Oregon-Washington coast southeast warnings were again displayed, which were verified by the occurrence of strong gales during the day. There was no occasion for warnings during the remainder of the month and no further displays were ordered.—*T. R. Reed.*

RIVERS AND FLOODS

By H. C. FRANKENFIELD

Report has already been made in the MONTHLY WEATHER REVIEW for September, 1926, of the destructive floods that occurred during that month in the rivers of Indiana, Illinois, Iowa, Missouri (except in the Missouri and Grand Rivers), eastern Kansas and eastern Oklahoma. In general the rains that caused these floods began during the second week of August and continued through the early days of October, although they were neither so widespread nor heavy during the second half of September. Over the Great Central Valleys the rainfalls for that month occurred generally in five principal periods (the last of which continued into October) as follows: September 1–6, 9, 12–16, 20, and 22–October 5. These rains were so phenomenal for the season that a table was prepared showing the general rain conditions for September over the flooded areas. The column showing the excess of rain above the normal amounts is especially significant.

Station	Drainage area	September rainfall: Number of days with 0.01 or more	September rainfall: Total amount	September rainfall: Excess over normal
Burlington, Kans	Neosho	9	12.30	7.96
Le Roy, Kans	do	12	20.10	15.85
Iola, Kans	do	13	14.28	10.42
Oswego, Kans	do	9	8.49	4.88
Wyandotte, Okla	do	9	12.48	
Fort Gibson, Okla	do	10	9.27	
Marion, Kans	Cottonwood	6	4.85	2.33
Emporia, Kans	do	11	11.82	8.29
Independence, Kans	Verdigris	13	9.07	5.30
Okay, Okla	do	10	10.02	
Calico Rock, Ark	White	11	4.70	1.13
Great Bend, Kans	Arkansas	9	6.58	
Wichita, Kans	do	10	[illegible].01	1.88
Arkansas City, Kans	do	11	8.51	
Ralston, Okla	do	10	12.16	
Fort Smith, Ark	do	9	6.83	3.66
Manhattan, Kans	Kansas	10	7.55	4.19
Topeka, Kans	do	14	6.38	2.82
Sioux Center, Iowa	Floyd	9	16.12	13.17
Le Mars, Iowa	do	8	6.79	3.56
Sioux City, Iowa	do	14	7.18	4.36
Inwood, Iowa	Big Sioux	8	6.46	3.67
Rock Rapids, Iowa	do	10	6.13	3.54
Boone, Iowa	Des Moines	14	11.77	7.72
Des Moines, Iowa	do	17	10.24	6.71
Ottumwa, Iowa	do	15	12.75	8.90
Van Meter, Iowa	Raccoon	16	9.97	
Gallatin, Mo	Grand	10	12.39	8.35
Chillicothe, Mo	do	14	11.33	5.59
Brunswick, Mo	do	15	11.17	6.78
Kidder, Mo	do	16	13.89	9.65
Trenton, Mo	Grand (Thompsons Fork).	18	11.86	7.60
Le Claire, Iowa	Mississippi	20	10.77	7.36
Davenport, Iowa	do	18	8.56	5.11
Muscatine, Iowa	do	17	8.85	5.25
Keokuk, Iowa	do	16	12.62	8.76
Warsaw, Ill	do	17	12.18	
Quincy, Ill	do	19	11.64	6.96
Hannibal, Mo	do	18	13.73	10.17
Louisiana, Mo	do	21	14.36	10.41
Grafton, Ill	do	16	7.35	3.63
St. Louis, Mo	do	15	5.58	2.67
Chester, Ill	do	13	4.31	.59
Gape Girardeau, Mo	do	12	2.79	.47
Cairo, Ill	do	11	4.47	2.00
South Bend, Ind	Illinois-Kankakee	18	4.97	1.78
Hamlet, Ind	do	16	5.83	
Wheatfield, Ind	do	17	7.56	4.62
Thayer, Ind	do	18	6.38	
Kankakee, Ill	do	18	10.35	7.28
Chicago, Ill	Lake Michigan	17	5.03	2.01
Aurora, Ill.[1]	Illinois	15	7.94	3.97
Pontiac, Ill.[1]	do	18	10.85	7.70
Morris, Ill	do	18	9.58	6.99
Peru, Ill	do	21	12.03	
Henry, Ill.[1]	do	18	10.84	7.26
Peoria, Ill	do	17	12.76	9.64
Havana, Ill	do	10	8.94	4.90
Beardstown, Ill	do	17	10.49	
Pearl, Ill	do	17	15.94	
Berne, Ind.[1]	Maumee	16	10.63	7.19
Fort Wayne, Ind	do	17	6.76	3.71
Defiance, Ohio [1]	do		8.38	5.63
Napoleon, Ohio	do	15	9.28	6.43
Toledo, Ohio	do	14	8.07	5.71
Bluffton, Ind	Wabash	17	8.62	5.59
Huntington, Ind.[1]	do	19	9.45	6.51
Wabash, Ind	do	17	7.86	4.82
Logansport, Ind	do	14	7.76	4.38
La Fayette, Ind	do	20	11.79	8.70
Terre Haute, Ind	do	17	11.06	7.66
Vincennes, Ind	do	13	6.30	2.63
Mount Carmel, Ill	do	10	5.54	2.29
Anderson, Ind.[1]	Wabash-White, West Fork.	15	11.77	8.40
Noblesville, Ind	do	16	14.58	10.91
Indianapolis, Ind	do	16	9.31	6.26
Elliston, Ind	do	11	6.15	2.94
Seymour, Ind. [1]	Wabash-White, East Fork.	16	7.29	4.05
Williams, Ind	do	15	8.04	
Shoals, Ind	do	16	6.59	3.15
Sidney, Ohio [1]	Miami	17	13.86	10.83
Dayton, Ohio	do	15	6.26	3.76
Franklin, Ohio	do	17	5.59	
Hamilton, Ohio	do	14	4.67	1.65
Larue, Ohio	Scioto	16	8.76	6.48
Bellpoint, Ohio	do	11	8.51	6.45
Columbus, Ohio	do	14	5.76	3.25
Circleville, Ohio	do	12	5.76	3.21
Dover, Ohio	Tuscarawas	18	10.87	8.32
Gnadenhutten, Ohio	do	11	9.93	
Coshocton, Ohio	do	16	10.80	7.28
Walhonding, Ohio	Walhonding	12	11.36	8.90

[1] Observations taken in evening.

Illinois River Flood.—The flood in the Illinois River was the most disastrous and prolonged one of the entire group. The river was already quite high from the August rains, and the heavy rains of August 31 and the early days of September were followed immediately by a rapid rise in the river to flood conditions, and it was not until November 29 that the entire river was below the flood stage. At the various gaging stations the river was above the flood stage as follows: Morris, Ill., 22 days; Peru, Ill., 81 days; Henry, Ill., 69 days; Peoria, Ill. 58 days; Havana, Ill. 84 days; Beardstown, Ill., 85 days; Pearl, Ill., 85 days. From Havana to Beardstown the stages were the highest of record, not even excepting the great flood of June, 1844.

There were two distinct floods in the Illinois River, the first from about September 4 until September 19, and the second, and greater, from about October 5 until the end of November. During this second flood the highest stages of record occurred from 10 miles above Havana to a short distance above Valley City, Ill., a reach of 68 miles. Valley City is 62 miles above the mouth of the river. The magnitude of the flood was much increased by the especially excessive rains over the tributary streams between Havana and Beardstown.

Above Peoria the damage was not very great. Below Peoria it was of the usual character, highways, bridges, railroads, light and power plants, wire communications, crops, livestock, etc., and in the first flood was greater along the tributaries than in the main stream. The damage from the second flood was more general, largely through the breaking of levees. Below Ottawa, Ill., there are about 475,000 acres of land below extreme high water level. Of these about 350,000 acres have been reclaimed by levees. During October there were flooded 24 levees and drainage districts, containing about 100,000 acres situated in 10 different counties, all below Peoria, and probably about 20,000 acres of unleveed cultivated lands were also flooded. The crops, mostly corn and small grains, were either mature, or harvested and left standing, and the losses at $25 an acre on leveed, and $10 an acre on unleveed lands, amounted to $2,700,000. Other losses amounted to about $1,000,000. These figures do not include loss and damage in regions above the high-water marks, nor in the city of Beardstown which was almost entirely inundated, boats being the sole means of intercourse. No estimate can be made of the damage done to this city. It covered every activity, and must have amounted to millions.

Warnings and advices were issued daily. Persistent efforts to obtain only approximations of the value of these warnings and advices failed. Replies stated, "A very large amount," "impossible to estimate"; "amount large; the information gave us something definite to look for and was of inestimable value aside from the actual saving of property. It was official information."

Wabash System of Indiana—Neither White River nor its Forks, with the exception of the lower West Fork, were unusually high, and the East Fork did not reach flood stage except at Seymour, Ind., during the three days, September 11–13. At Elliston, Ind., on the West Fork, the crest stage of 28.8 feet on September 14 was 9.8 feet above the flood stage, while at Edwardsport, 21 miles below, the crest of 19.95 feet on September 15 was 4.95 feet above flood stage. At Decker, Ind., on White River, the crest stage of 21.2 feet on September 19 was 3.2 feet above flood stage. The second and smaller flood in the West Fork crested between October 5 and 7 over the lower river, but at Noblesville, Ind., on the upper river, there was a crest slightly above flood stage on September 26.

There was not much damage over the upper reaches, but over the middle and lower sections the damage to

standing crops that could not be removed was about $1,300,000.

Advices were issued in advance of the floods in ample time to enable those interested to take such precautionary measures as were possible.

In the Wabash River flood conditions prevailed from the vicinity of Lafayette, Ind., southward to the Ohio River. The soil was saturated, and the rains were heavy, 5.16 inches having fallen at Terre Haute, Ind., within a period of 8 hours and 52 minutes during the evening of Sept. 8 and early morning of Sept. 9. Crest stages may be found in the table at the end of this report. The second flood was much like the first, though somewhat greater in the vicinity of Lafayette.

Warnings and frequent advices were issued for both floods, with the exception of the sharp rise at Terre Haute on September 8–9, due to the torrential rains mentioned above. No warnings for this flood could have been issued as the rainfall was much too heavy within a very short period of time.

As expected, the major portion of the loss and damage fell upon agricultural sections. Very incomplete reports showed losses from unharvested crops of $1,620,750 and from unhoused crops of $22,000. The flood waters covered 107,650 acres of corn and 1,000 acres of truck crops. Other losses were of the usual character and relatively not very heavy, only about $141,000 having been reported.

In the State of Ohio the floods were very moderate and the losses were not serious as a whole. Corn in the lowlands of the Scioto River was damaged. The rise in the Ohio River, while marked, was not in any way dangerous. The maximum stage at Cairo, Ill., was 40.8 feet on October 12, but much of this rise came from the Mississippi River which was somewhat above flood stage below the mouth of the Des Moines River except in the immediate vicinity of St. Louis, Mo.

Mississippi River.—The Mississippi River was above flood stage at the beginning of the month from Quincy, Ill., almost to the mouth of the Ohio. However, the records indicate that, except in the Hannibal, Mo., district, the floods were very moderate and caused no damage of consequence. In the Hannibal district the leveed areas suffered greatly. All the lower portions thereof were under water from the heavy rains, and the rising Mississippi both prevented gravity drainage and brought down a supply of water far exceeding the capacity of the pumping plants. The water remained high until late in October, preventing drainage, as well as the seeding of winter wheat, except on the highest ground. The losses in crops amounted to about $500,000, and it was stated that the corn crop was damaged about as much per acre within the levee districts as on the unprotected bottom lands. The total reported losses in the district during September and October amounted to $953,000, and the total acreage overflowed was about 75,000.

The warnings for these floods were timely and very accurate, and losses other than crops were reduced to a minimum.

From the mouth of the Illinois River to a short distance below the mouth of the Missouri River the crest stages again were higher than ever before during an autumn month, and at Grafton, Ill., at the mouth of the Illinois, the river was above the flood stage of 18 feet for 26 days. A large amount of bottom-land corn was lost. The rise of the river was not rapid, and under ordinary conditions the warnings would have saved all of the corn. As it happened the heavy rains had made the ground so soft that the corn could not be hauled from the bottoms. From the mouth of the Missouri to the mouth of the Ohio the losses were confined to corn and some little cotton on very low unprotected lands. About 2,200 acres were overflowed below Cape Girardeau, Mo., with resulting loss of about $42,000. Other losses were negligible.

Missouri River.—Nearly bankful stages prevailed in in the Missouri River from September 5 to October 20, but there were no actual flood stages except a crest of 26 feet (flood stage 25 feet) at St. Charles, Mo., on September 12. A little corn was lost in low bottoms below Waverly, Mo.

Grand River of Missouri.—There were two severe floods in the Grand River, one in September and the other in October (see flood table). Much corn was lost, and transportation of all kinds interrupted. There was no loss of life, and nearly all livestock was removed from bottoms well in advance of the high water, ample warning of which had been given.

Osage River of Missouri.—Only moderate floods occurred in the Osage River, and the only losses were a little corn in low bottoms.

Arkansas River Basin.—During the closing days of September rains to an average amount of more than 5 inches fell upon the wet soil of the lower Arkansas and lower Neosho Valleys, and on September 29 flood warnings were issued for the Arkansas River below the mouth of the Neosho. Moderate floods occurred as forecast. Similar conditions prevailed at the same time over the Arkansas and White River drainage areas in Arkansas, and warnings were issued in ample time. More general and heavy rains during the first three days of October resulted in another flood in the main river and tributaries that was further augmented by additional heavy rains on October 10. Over some of the lower portion of the Wichita, Kans., district the rainfall approximated 10 inches, and in a short time the Arkansas River was in flood from the vicinity of Wichita to the mouth. Warnings were issued promptly throughout the district, and for a time Fort Smith, Ark., and the section below were confronted with the unpleasant prospect of a really great flood. It happened, however, that levees gave way in several places between Fort Smith and Little Rock, Ark., greatly relieving the situation. As soon as this occurred, advices were issued accordingly. All tributaries in the State of Kansas, including the Cottonwood, Neosho, Ninescah, Walnut, and Little Arkansas Rivers, were also in flood. These sections were also covered by warnings. Additional advices were issued daily until the waters subsided.

Six lives were lost during these floods, all in the State of Oklahoma, and it was stated that four persons were drowned in vain attempts to ford swollen streams. The losses as reported aggregated $3,920,400, of which $2,597,000 was in crops, $911,000 in other property, and $412,400 due to enforced suspension of business. Of the total losses the Fort Smith district contributed about five-eighths, with about 100,000 acres of land overflowed, of which 50,000 acres were in the valleys of the Verdigris and Caney Rivers.

Rivers of Texas.—An unimportant flood that was well forecast occurred in the vicinity of Trinidad, Tex., between October 9 and 15. No losses were reported. There was also a moderate flood on October 18 and 19 in the lower Rio Grande in the vicinity of San Benito for which, apparently, warnings were not necessary.

Floods in small streams.—No specific mention has been made of the many floods that occurred in very small streams. These were usually due to torrential rains within short periods of time, frequently at night, and beyond possibility of effective warnings. The losses caused by these floods probably amounted to an additional $1,000,000 or more, and in many instances they were proportionately greater than those caused by the larger streams.

River	Station	Flood stage	Above flood stages—dates		Crest	
			From—	To—	Stage	Date
MISSISSIPPI DRAINAGE						
		Feet			Feet	
Shenango	Sharon, Pa	9	25	26	9.7	25
Tuscarawas	Gnadenhutten, Ohio	9	26	27	10.6	26
Walhonding	Walhonding, Ohio	8	31	31	8.6	31
Scioto	Larue, Ohio	11	5	7	12.7	6
	Prospect, Ohio	10	7	8	10.8	7
	Circleville, Ohio	10	7	8	11.4	7
Wabash	Lafayette, Ind	11	[1]	8	18.5	5
	Terre Haute, Ind	16	[1]	12	20.7	6-7
	Vincennes, Ind	14	3	15	19.0	11
	Mt. Carmel, Ill	16	4	17	21.1	11
Tippecanoe	Norway, Ind	6	[1]	11	6.5	[2] 2, 3, 6, 7
			15	15	6.0	15
			20	20	6.0	20
			25	25	6.2	25
White, West Fork	Edwardsport, Ind	15	1	10	17.85	7
Mississippi	Quincy, Ill	14	[1]	9	16.0	3 & 6
	Hannibal, Mo	13	[1]	12	16.7	3, 4, & 6
	Louisiana, Mo	12	[1]	13	16.8	4
	Grafton, Ill	18	[1]	17	23.7	6
	Alton, Ill	21	[1]	17	26.2	8
	Chester, Ill	27	6	15	28.8	9
	Cape Girardeau, Mo	30	5	17	32.9	10
Illinois	Morris, Ill	13	[1]	10	16.5	5
	Peru, Ill	14	[1]	[3]	23.4	7
	Henry, Ill	10	[1]	[3]	18.2	8 & 9
	Peoria, Ill	18	[1]	29	25.02	9
	Havana, Ill	14	[1]	[3]	23.47	12
	Beardstown, Ill	14	[1]	[3]	26.25	12
	Pearl, Ill	12	[1]	[3]	22.0	6 & 7
Missouri	St. Charles, Mo	25	7	13	26.0	12
Grand	Gallatin, Mo	20	2	7	33.5	6
			10	11	25.7	10
	Chillicothe, Mo	18	2	12	28.8	7
	Brunswick, Mo	12	6	12	13.6	9 & 10
Osage	Osceola, Mo	20	7	7	20.0	7
			10	12	22.5	11
	Warsaw, Mo	22	4	7	23.8	5
			10	13	24.6	11
	Tuscumbia, Mo	25	6	7	25.8	6 & 7
			10	14	26.2	12
Arkansas	Arkansas City, Kans	19	3	5	[4] 21.0	4
	Fort Smith, Ark	22	1	1	22.0	1
			4	16	29.1	11
	Dardanelle, Ark	20	6	17	25.7	12
	Pine Bluff, Ark	25	12	18	25.8	15
	Yancopin, Ark	29	7	29	35.5	19 & 20
Little Arkansas	Sedgewick, Kans	18	3	4	20.4	3
			13	13	18.0	13
Neosho	Neosho Rapids, Kans	22	5	7	23.9	6
	Le Roy, Kans	24	3	8	26.1	4
	Iola, Kans	15	3	8	18.0	5 & 6
	Oswego, Kans	17	3	12	23.3	10
Cottonwood	Elmdale, Kans	32	4	4	32.04	4
	Emporia, Kans	20	4	7	24.1	5
White	Calico Rock, Ark	18	1	1	18.1	1
			30	30	19.3	30
	Batesville, Ark	23	1	2	25.5	1
Sulphur	Ringo Crossing, Tex	20	11	17	22.8	13
WEST GULF DRAINAGE						
Trinity	Trinidad, Tex	28	9	15	29.7	14
Rio Grande	San Benito, Tex	21	18	19	21.5	18

[1] Continued from last month.
[2] Also Sept. 26 and 30.
[3] Continued at end of month.
[4] Estimated.

MEAN LAKE LEVELS DURING OCTOBER, 1926

By UNITED STATES LAKE SURVEY

[Detroit, Mich., November 4, 1926]

The following data are reported in the "Notice to Mariners" of the above date:

Data	Lakes [1]			
	Superior	Michigan and Huron	Erie	Ontario
Mean level during October, 1926:	Feet	Feet	Feet	Feet
Above mean sea level at New York	601.68	578.32	574.10	244.93
Above or below—				
Mean stage of September, 1926	+0.38	−0.19	+0.26	+0.07
Mean stage of October, 1925	+0.29	+0.41	+1.09	+0.61
Average stage for October, last 10 years	−0.70	−1.47	−0.18	−0.62
Highest recorded October stage	−2.96	−4.72	−2.01	−2.88
Lowest recorded October stage	+0.29	+0.41	+1.09	+1.26
Average departure (since 1860) of the October level from the September level	−0.05	−0.23	−0.32	−0.35

[1] Lake St. Clair's level: In October, 1926, 574.10 feet.

EFFECT OF WEATHER ON CROPS AND FARMING OPERATIONS, OCTOBER, 1926

By J. B. KINCER

General summary.—Rains in September were persistent in most of the interior valley States, and they continued during the first week in October, with resulting weather conditions decidedly unfavorable for maturing crops and for fall operations. Very little field work was possible in the Central and Northern States from the Mississippi Valley eastward, and the saving of frosted corn in the northwestern portion of the Corn Belt, where the crop was damaged the latter part of September, was retarded.

After the first week of the month, however, the weather in the interior of the country was much more favorable for agricultural interests, as the sunshiny, generally dry, and moderately warm conditions favored both outside operations and the drying out of crops. The dry weather was especially favorable in the central portions of the Corn and Winter Wheat Belts, but at the same time the lack of sufficient sunshine and rather frequent showers delayed the usual fall operations in much of the Northeast.

The first general frost of the season overspread the lower Missouri and Ohio Valley States on the 24–27th, with a light deposit extending as far south as the northern portion of the east Gulf area, but damage was not material, as staple crops had practically all matured. The frost over this large and important agricultural section came later than in an average year, and the southern progress of the first freeze of the season was still somewhat behind an average year in most sections, especially east of the Mississippi River, at the close of the month.

Small grains.—During the first part of the month the seeding of winter grains was further delayed in the Central States east of the Great Plains because of frequent rains and wet soil, but in the western part of the Wheat Belt progress was more favorable. The middle and latter parts had better weather for field work in the central and eastern portions, and good progress was made quite generally in fall seeding, though the previous wet weather resulted in a reduction of the intended acreage in some of the interior valley States and parts of the middle Atlantic area. The crop did well quite generally in the western portion of the belt, except where it was too dry in western Kansas and some adjoining sections. West of the Rocky Mountains moisture was insufficient for wheat in the Great Basin, and locally in the Pacific Northwest, but conditions in the latter area were mostly favorable.

Corn.—Except in the western portion of the Corn Belt, the month was mostly unfavorable for drying out the crop, and the moist conditions retarded the saving of frosted corn in some northwestern districts. A cessation in rains, however, toward the middle of the month made better conditions than had previously prevailed in the middle Mississippi and Ohio Valley States, and the delayed occurrence of frost in those areas was favorable in permitting the crop to mature without material damage from that source. In the South, conditions were generally favorable for maturing and harvesting the crop, while it matured in the Great Plains States without material frost damage.

Cotton.—The month, on the whole, was favorable for the cotton crop, although it was too cloudy and rainy in the northwestern portion of the belt during part of the period. In Texas the progress was generally fair, with insects less active, but prospects for a top crop still poor. Picking and ginning were delayed considerably in the northwestern portion of the belt, because of unfavorable weather. This was especially true in Oklahoma during the early part of the month, when rainfall was heavy to excessive, with many lowlands flooded. In the central and eastern portions of the belt the weather was generally favorable for field work, and harvest in general made excellent progress.

Miscellaneous crops.—Pastures continued mostly good for the season east of the Mississippi River, except that they needed rain badly in the south Atlantic area, and were too dry locally in some central Gulf districts. Ranges continued mostly good in the West, except where too dry in parts of the Rocky Mountain area, and quite generally in the Great Basin. Livestock over the great western grazing country were mostly in satisfactory condition.

There was considerable complaint of the rotting of undug potatoes in interior valley, Lake, and Northeastern States, and harvest was interrupted by wet soil in those sections, but elsewhere digging progressed satisfactorily. Sugar beet harvest was well along generally at the close of the month and nearly finished in most districts. While the weather was fairly favorable for sugar cane in Louisiana, the crop was reported as mostly poor. Conditions were generally favorable for deciduous and citrus fruits.

CLIMATOLOGICAL TABLES[1]

CONDENSED CLIMATOLOGICAL SUMMARY

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Condensed climatological summary of temperature and precipitation by sections, October, 1926

Section	Temperature							Precipitation					
	Section average	Departure from the normal	Monthly extremes						Section average	Departure from the normal	Greatest monthly		Least monthly	
			Station	Highest	Date	Station	Lowest	Date			Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	66.9	+2.5	Brewton	98	[2] 1	Florence	30	25	2.10	−0.52	Fayette	5.50	Union Springs	0.21
Arizona	65.0	+2.9	Canon	106	4	2 stations	17	[2] 21	0.55	−0.23	Blue	3.42	13 stations	0.00
Arkansas	64.9	+2.7	Portland	99	2	Dutton	23	25	5.77	+2.80	Texarkana	12.08	Georgetown	2.49
California	62.4	+1.9	Indio	106	17	Tamarack	7	29	1.25	+0.03	Crescent City	8.47	14 stations	0.00
Colorado	48.4	+2.2	Lamar	99	17	Dillon	−10	31	0.90	−0.32	Savage Basin	3.70	Lamar	0.00
Florida	73.8	+0.8	Brooksville	98	[2] 4	Mount Pleasant	32	27	2.63	−1.71	Long Key	15.22	Federal Point	0.18
Georgia	66.8	+2.2	Lisbon	99	3	Clayton	25	27	1.56	−1.20	Clayton	4.98	2 stations	0.44
Idaho	48.5	+1.9	Chattins Flat	90	16	Stanley	2	30	0.90	−0.56	Bungalow Ranger Station.	5.34	4 stations	0.00
Illinois	54.7	−0.5	Harrisburg	92	2	Rockford	20	26	3.79	+1.17	Clinton	7.46	Walnut	1.20
Indiana	55.0	+0.5	Washington	92	1	5 stations	22	[2] 26	4.32	+1.63	Paoli	7.61	Whiting	1.23
Iowa	51.2	−0.7	Mount Pleasant	91	8	Inwood	14	30	1.53	−0.89	Lamoni	3.91	Little Sioux	0.11
Kansas	58.6	+1.6	3 stations	99	17	Gove (near)	18	24	2.83	+0.93	Sedan	11.61	2 stations	0.00
Kentucky	59.3	+1.2	Murray	94	1	2 stations	25	[2] 25	5.96	+3.36	Salvisa	9.60	Pikesville	2.12
Louisiana	71.7	+3.8	Dodson	98	2	Lake Providence	25	25	4.43	+1.24	Covington	8.90	Grand Cane	1.16
Maryland-Delaware	56.0	−0.3	Western Port, Md	94	3	Oakland, Md	21	28	3.28	+0.42	Darlington, Md	5.61	Bridgeville, Del	1.59
Michigan	46.6	−3.0	Midland	89	4	Houghton Lake (near).	12	31	3.11	+0.22	Petoskey	5.42	Alpena	1.75
Minnesota	44.0	−2.3	Lynd	82	[1] 1	2 stations	10	[2] 29	2.23	+0.32	Redby	4.02	Lynd	0.05
Mississippi	68.7	+3.7	3 stations	99	[2] 1	University	27	25	2.87	+0.10	Woodville	7.01	Jackson	0.92
Missouri	57.3	−0.1	Caruthersville	93	2	Lebanon	21	25	4.67	+1.92	Eldon	8.66	Hailey	1.35
Montana	47.2	+2.8	Harlowton	84	17	Outlook	8	23	0.53	−0.49	Trout Creek	2.64	5 stations	0.00
Nebraska	53.5	+2.6	Hastings	96	17	2 stations	8	[2] 24	1.06	−0.50	Falls City	3.93	2 stations	0.00
Nevada	53.9	+2.8	Las Vegas	96	15	Rye Patch	4	30	0.17	−0.51	Mahoney Ranger Station.	0.71	9 stations	0.00
New England	47.6	−1.8	Rutland, Vt	87	6	Chelsea, Vt	11	22	5.02	+1.47	Machias, Me	13.90	Rumford, Me	2.52
New Jersey	53.1	−1.8	Indian Mills	90	4	Charlotteburg	17	28	4.08	+0.32	Runyon	6.03	Bridgeton	1.79
New Mexico	55.7	+2.5	Clayton	93	17	Red River Canyon	3	31	1.35	+0.12	Cloudcroft	4.40	Shiprock	0.01
New York	48.5	−1.4	2 stations	90	[2] 4	Roxbury	15	28	4.88	+1.66	High Market	9.39	Harkness	1.80
North Carolina	61.8	+1.6	Kinston	97	4	Mount Mitchell	11	26	1.84	−1.37	Rock House (No. 1)	4.77	Goldsboro	0.32
North Dakota	42.6	−1.2	Beach	85	6	Hansboro	4	24	1.49	+0.49	Larimore	5.06	3 stations	T.
Ohio	53.7	−0.3	3 stations	90	3	Findlay	21	27	5.14	+2.48	Wilmington	8.46	Bellefontaine	2.68
Oklahoma	64.6	+2.8	Durant	96	1	Hooker	23	31	5.01	+1.98	Erick	9.38	Goodwell	0.04
Oregon	52.3	+1.8	3 stations	86	[2] 5	2 stations	3	29	2.92	+0.69	Valsetz	15.77	Vale	T.
Pennsylvania	51.9	−0.5	Clearfield	90	4	Gouldsboro	16	[2] 27	4.51	+1.33	Erie	7.98	Philadelphia Navy Yard.	2.56
South Carolina	65.1	+1.5	Calhoun Falls	96	1	Caesar's Head	26	26	1.44	−1.51	Hogback Mountain	4.51	Rimini	0.00
South Dakota	49.6	+1.0	Vivian	90	7	2 stations	11	30	1.37	+0.07	Mellette	3.96	2 stations	0.10
Tennessee	61.9	+2.2	Perryville	96	[2] 2	2 stations	25	[2] 25	4.44	+1.58	Cedar Hill	9.50	Parkesville	1.57
Texas	71.4	+3.9	Victoria	109	11	Dalhart	21	31	4.00	+1.41	Sherman	14.19	Spearman	0.15
Utah	50.7	+2.5	Saint George	93	26	Woodruff	4	31	0.33	−0.97	La Sal	1.72	14 stations	0.00
Virginia	58.4	+0.7	Fredericksburg	93	4	Burkes Garden	20	26	3.22	+0.02	Saltville	6.24	Clarksville	0.74
Washington	50.8	+1.4	La Center	79	4	2 stations	18	[2] 23	3.53	+0.56	Spruce	16.59	Wapato	0.10
West Virginia	54.9	−0.3	2 stations	92	[2] 3	3 stations	20	[2] 26	4.79	+1.72	Bayard	8.74	Bluefield	1.04
Wisconsin	45.3	−2.7	Kilbourn	84	4	Long Lake	5	31	2.97	+0.34	Solon Springs	5.90	Ladysmith	1.63
Wyoming	45.5	+2.4	2 stations	84	17	Foxpark	11	30	0.93	−0.22	Lagrange	2.61	Pinedale	0.03
Alaska (September)	49.7	+3.5	Hydaburg	78	11	3 stations	20	[2] 16	3.56	−4.19	Latouche	13.62	Skagway	0.66
Hawaii	74.4	+0.9	2 stations	94	[2] 12	Waimea	51	17	4.55	−1.45	Piihonua	16.90	Kaanapali	0.00
Porto Rico	78.4	+0.2	7 stations	95	[2] 1	Jayuya	54	[2] 14	6.94	−1.37	Maricao	17.00	Mona Island	0.51

[1] For description of tables and charts, see REVIEW, January 1926, p. 32.

[2] Other dates also.

TABLE 1.—*Climatological data for Weather Bureau stations, October, 1926*

Districts and stations	Elevation of instruments: Barometer above sea level	Elevation: Thermometer above ground	Elevation: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature: Mean max. + mean min. ÷ 2	Temperature: Departure from normal	Temperature: Maximum	Date	Mean maximum	Minimum	Date	Mean minimum	Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Days with 0.01, or more	Wind: Total movement	Prevailing direction	Maximum velocity: Miles per hour	Maximum velocity: Direction	Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	In.	In.		Miles								0-10	In.	In.
New England							49.9	−1.1										78	5.26	+1.7										6.1		
Eastport	76	67	85	29.79	29.88	−.12	46.8	−0.7	65	3	53	30	20	40	21	45	42	84	9.54	+5.7	12	8,784	s.	47	s.	25	3	12	16	7.2	T.	0.0
Greenville, Me.	1,070	6	----	28.72	29.89	----	43.2	----	67	5	51	24	20	35	27	----	----	----	3.87	----	12	5,949	nw.	33	----	25	5	8	18	----	9.2	0.0
Portland, Me.	103	82	117	29.81	29.94	−.10	49.2	−0.7	71	5	57	32	22	41	27	44	40	74	4.37	+0.7	12	6,675	nw.	43	s.	25	12	7	12	5.2	0.5	0.0
Concord	289	70	79	29.61	29.93	−.12	47.4	−2.3	86	5	59	22	28	36	38	----	----	----	4.45	+1.2	12	3,799	nw.	33	sw.	25	11	11	9	5.4	0.7	0.0
Burlington	403	11	48	29.48	29.92	−.12	46.4	−2.8	82	5	54	25	28	39	29	----	----	----	5.04	+1.9	14	7,732	s.	44	s.	25	2	7	22	8.2	3.6	0.0
Northfield	876	12	60	----	29.94	−.10	43.0	−2.5	83	5	53	18	22	33	36	40	38	84	5.37	+2.9	18	5,069	s.	40	sw.	25	4	7	20	7.7	7.0	0.0
Boston	125	115	188	29.80	29.93	−.12	53.4	−0.2	84	5	62	35	28	45	27	48	44	74	3.58	−0.3	9	7,203	sw.	36	sw.	25	10	11	10	5.5	0.0	0.0
Nantucket	12	14	90	29.92	29.93	−.12	53.9	−0.3	74	3	60	40	20	48	22	50	48	82	6.86	+3.5	12	11,873	sw.	58	s.	25	7	9	15	6.3	0.0	0.0
Block Island	26	11	46	29.91	29.94	−.11	54.0	−0.9	73	5	60	40	28	48	20	50	47	77	5.82	+1.7	10	13,929	nw.	58	sw.	25	11	7	13	5.5	0.0	0.0
Providence	160	215	251	29.77	29.94	−.11	51.6	−0.6	76	5	60	33	22	43	27	47	42	72	4.62	+0.8	11	9,229	nw.	48	s.	24	12	9	10	5.3	0.0	0.0
Hartford	159	122	----	29.77	29.94	−.12	51.2	0.0	79	5	60	30	28	42	30	----	----	----	4.16	+0.3	10	----	nw.	----	----	----	13	7	11	5.1	T.	0.0
New Haven	106	74	153	29.84	29.96	−.10	52.2	−1.6	70	3	61	32	22	44	30	48	44	75	4.02	+0.1	12	6,710	sw.	44	sw.	25	7	11	13	6.0	0.0	0.0
Middle Atlantic States							55.6	−0.7										78	3.39	+0.1										5.8		
Albany	97	102	115	29.84	29.94	−.12	49.6	−2.5	83	5	58	28	28	41	27	40	44	86	3.60	+0.6	13	5,217	s.	31	s.	16	7	9	15	6.2	0.2	0.0
Binghamton	871	10	84	29.02	29.96	−.10	47.8	−2.2	85	4	58	25	28	38	35	----	----	----	4.24	+1.1	16	4,069	nw.	27	se.	24	2	10	19	7.5	1.4	0.0
New York	314	414	454	29.62	29.96	−.10	54.2	−2.1	80	3	62	34	26	47	28	49	45	75	5.11	+1.4	9	11,739	nw.	74	sw.	25	8	9	14	6.4	T.	0.0
Harrisburg	374	94	104	29.58	29.98	−.10	54.2	−0.6	84	5	62	31	28	46	27	49	45	77	3.90	+1.0	12	4,298	nw.	29	sw.	25	5	13	13	6.5	0.0	0.0
Philadelphia	114	123	190	29.85	29.98	−.09	57.0	−0.8	86	4	64	36	26	49	29	52	48	75	4.11	+1.0	12	6,367	sw.	37	sw.	25	9	11	11	5.7	0.0	0.0
Reading	325	81	98	29.62	29.97	----	54.6	----	86	5	64	31	28	45	30	50	47	80	3.69	+0.4	10	4,155	nw.	27	w.	25	9	9	13	6.2	0.0	0.0
Scranton	805	111	119	29.10	29.97	−.10	49.6	−2.3	85	4	59	27	28	40	32	47	45	86	3.72	+0.8	15	4,851	s.	29	se.	22	3	9	19	7.6	0.0	0.0
Atlantic City	52	37	172	29.91	29.97	−.10	56.8	−0.1	81	3	64	35	28	49	27	53	49	78	2.90	−0.4	9	12,186	s.	61	sw.	25	12	9	10	4.7	0.0	0.0
Cape May	17	13	49	----	----	----	57.4	−2.2	84	3	66	35	27	49	30	----	----	----	1.95	−1.4	8	----	n.	----	----	----	----	----	----	----	0.0	0.0
Sandy Hook	22	10	55	29.94	29.96	----	55.1	----	77	5	61	36	26	49	27	50	47	76	3.68	----	11	12,021	nw.	62	sw.	25	9	10	12	5.6	0.0	0.0
Trenton	190	159	183	29.76	29.96	----	54.3	----	85	5	63	33	26	45	30	50	46	78	4.09	+0.7	11	7,353	nw.	48	sw.	25	11	11	9	5.6	0.0	0.0
Baltimore	123	100	215	29.84	29.97	−.11	58.0	−0.2	87	5	66	36	27	50	30	53	49	77	4.24	+1.2	10	6,547	sw.	46	w.	25	12	9	10	5.4	0.0	0.0
Washington	112	62	85	29.86	29.98	−.10	57.2	−0.2	88	4	66	32	28	48	31	52	49	80	4.23	+1.1	10	3,942	nw.	36	nw.	25	9	10	12	6.1	0.0	0.0
Cape Henry	18	8	54	29.96	29.98	----	63.8	----	84	5	71	42	26	57	31	57	52	72	2.31	−1.6	8	10,109	sw.	56	n.	31	13	10	8	4.5	0.0	0.0
Lynchburg	681	153	188	29.26	30.00	−.09	59.2	+0.7	89	3	70	30	28	49	38	52	48	75	3.16	−0.2	10	4,610	nw.	32	nw.	25	12	9	10	5.3	0.0	0.0
Norfolk	91	170	205	29.90	30.00	−.07	63.0	+0.5	89	4	71	40	26	55	29	56	51	73	1.65	−2.3	8	9,135	s.	58	sw.	25	14	8	9	4.9	0.0	0.0
Richmond	144	11	52	29.85	30.00	−.08	60.2	+0.6	90	4	71	29	28	50	37	54	51	79	0.81	−2.5	8	5,322	sw.	38	w.	25	13	10	8	4.4	0.0	0.0
Wytheville	2,304	49	55	27.64	30.01	−.08	54.8	+1.2	83	3	64	28	28	45	36	50	48	84	3.90	+0.8	14	3,946	w.	36	w.	18	10	9	12	5.5	T.	0.0
South Atlantic States							66.1	+1.9										76	1.60	−2.1										4.6		
Asheville	2,253	70	84	27.69	30.03	−.06	57.2	+1.9	83	3	67	30	26	48	37	52	49	81	1.29	−1.2	9	5,424	se.	33	n.	31	11	7	13	5.5	T.	0.0
Charlotte	779	55	62	29.18	30.01	−.07	63.6	+1.9	91	3	74	33	26	54	32	55	51	71	0.64	−2.5	8	2,692	sw.	18	w.	5	10	12	9	5.2	0.0	0.0
Hatteras	11	11	50	29.98	29.99	−.07	66.8	+0.9	84	5	73	48	26	60	25	62	58	76	3.74	−2.3	8	10,162	n.	54	w.	25	15	8	8	4.3	0.0	0.0
Raleigh	376	103	110	29.61	30.01	−.06	63.2	+1.2	90	3	74	36	27	53	34	55	51	74	1.65	−1.8	8	5,289	sw.	34	w.	25	12	10	9	4.9	0.0	0.0
Wilmington	78	81	91	29.94	30.02	−.04	66.8	+1.5	87	3	76	38	28	57	29	60	57	79	1.46	−2.3	13	4,477	w.	33	w.	25	16	11	4	3.7	0.0	0.0
Charleston	48	11	92	29.96	30.01	−.05	70.0	+2.2	90	19	78	37	27	62	26	63	60	76	0.85	−3.1	5	6,412	n.	36	nw.	25	13	14	4	4.2	0.0	0.0
Columbia, S. C.	351	41	57	29.65	30.03	−.04	67.0	+2.7	90	3	78	35	27	56	31	58	54	71	0.99	−1.9	6	4,161	s.	27	s.	24	12	9	10	4.7	0.0	0.0
Due West	711	10	55	29.28	30.05	----	64.0	----	88	3	75	34	27	53	30	----	----	----	1.49	----	7	5,402	sw.	37	w.	24	12	12	7	4.6	0.2	0.0
Greenville, S. C.	1,039	139	146	28.92	30.00	----	63.4	+3.2	87	3	72	34	27	55	26	56	51	73	2.46	----	7	5,607	sw.	32	sw.	24	15	5	11	4.5	T.	0.0
Augusta	182	62	77	29.82	30.01	−.06	67.7	+2.4	92	1	79	37	28	56	34	60	58	79	1.11	−1.2	6	3,410	nw.	25	nw.	24	15	13	3	4.1	0.0	0.0
Savannah	65	150	194	29.94	30.02	−.03	69.6	+1.7	90	1	78	39	27	61	25	62	58	75	2.03	−1.5	6	6,937	ne.	44	w.	25	13	10	8	4.3	0.0	0.0
Jacksonville	43	200	245	29.95	30.00	−.02	72.0	+0.9	89	5	79	40	27	64	22	64	61	76	2.22	−2.8	5	7,284	e.	41	nw.	25	10	15	6	4.8	0.0	0.0
Florida Peninsula							78.0	+0.9										77	6.10	+0.4										4.2		
Key West	22	10	64	29.90	29.92	−.02	79.2	+0.1	88	3	84	65	28	74	16	73	71	78	9.84	+4.5	13	7,879	e.	62	n.	20	14	12		53.9	0.0	0.0
Miami	25	71	79	29.93	29.96	----	79.4	+1.6	91	1	85	59	28	74	22	72	69	74	6.92	−2.0	13	4,631	se.	52	n.	21	8	16		75.5	0.0	0.0
Tampa	35	79	87	29.94	29.97	−.01	75.4	+1.1	91	4	84	49	27	67	24	68	66	79	1.53	−1.4	8	4,235	e.	25	sw.	24	14	12		54.1	0.0	0.0
Titusville	44	5	----	29.93	29.98	----	75.1	----	92	6	84	45	26	66	31	----	----	----	3.15	----	10	----	sw.	----	----	----	21	7		33.4	0.0	0.0
East Gulf States							68.2	+1.8										75	2.24	−0.5										4.3		
Atlanta	1,173	190	216	28.80	30.03	−.04	64.5	+1.5	89	1	73	36	25	56	26	56	52	69	1.68	−0.7	8	7,156	nw.	40	nw.	24	14	4	13	4.8	T.	0.0
Macon	370	78	87	29.62	30.02	−.04	66.2	+1.7	90	1	78	34	27	55	36	58	54	74	0.73	−1.4	7	3,589	nw.	24	nw.	24	15	7	9	4.1	0.0	0.0
Thomasville	273	49	58	29.71	30.00	−.04	69.6	+1.4	90	1	80	38	27	59	29	61	58	74	1.54	−1.9	5	2,660	e.	20	w.	24	13	11	7	4.4	0.0	0.0
Apalachicola	36	42	49	29.95	29.99	----	71.5	----	88	5	79	45	27	64	25	65	62	78	3.26	----	6	5,825	n.	27	w.	26	20	8	3	3.0	0.0	0.0
Pensacola	56	149	185	29.94	30.00	−.03	71.0	+1.1	86	14	78	45	27	64	25	65	62	76	5.41	+1.3	6	9,014	n.	39	w.	26	15	10	6	4.2	0.0	0.0
Anniston	741	9	57	29.25	30.04	−.03	63.6	+1.2	90	1	75	34	27	52	37	----	----	----	3.05	+0.7	10	3,039	s.	22	nw.	24	14	8	9	4.4	0.0	0.0
Birmingham	700	11	48	29.27	30.03	−.04	65.9	+1.2	90	4	76	34	25	56	33	58	54	74	1.12	−1.2	9	4,669	s.	22	w.	24	14	8	9	4.4	0.0	0.0
Mobile	57	125	161	29.94	30.00	−.04	71.2	+1.9	89	1	80	44	25	63	27	64	61	74	1.64	−1.5	7	6,825	n.	34	nw.	24	15	10	6	3.9	0.0	0.0
Montgomery	223	100	112	29.78	30.03	−.03	67.8	+1.2	90	1	78	39	27	58	30	60	56	72	1.80	−0.6	6	4,173	se.	30	nw.	24	14	11	6	4.1	0.0	0.0
Corinth	469	6	----	----	----	----	66.2	----	93	1	78	32	25	55	35	----	----	----	4.26	----	11	----	s.	----	----	----	3	24	4	----	0.0	0.0
Meridian	375	87	95	29.61	30.01	−.05	67.5	+3.0	90	4	78	35	25	57	34	60	58	79	1.61	−1.1	8	3,474	se.	23	nw.	24	13	7	11	5.0	0.0	0.0
Vicksburg	247	65	73	29.73	30.01	−.05	69.5	+2.8	93	2	78	39	25	61	29	62	58	74	1.57	−1.2	8	4,570	se.	28	nw.	24	13	8	12	5.1	0.0	0.0
New Orleans	53	76	84	29.94	29.99	−.04	74.0	+3.0	91	4	81	54	25	67	19	66	63	76	4.48	+1.6	7	4,463	se.	20	n.	11	12	11	8	4.7	0.0	0.0
West Gulf States							71.8	+4.0										76	3.82	+1.0										4.7		
Shreveport	249	77	93	29.72	29.99	−.06	71.0	+4.4	92	2	80	43	25	62	30	64	61	78	4.76	+1.6	8	4,457	se.	25	s.	28	12	10	9	4.7	0.0	0.0
Bentonville	1,303	11	44	----	----	----	66.6	+2.6	88	2	70	30	25	51	32	----	----	----	4.71	----	12	3,816	s.	21	s.	3	14	4	13	----	0.0	0.0
Fort Smith	457	79	94	29.48	29.96	−.09	65.0	+2.2	88	2	74	34	25	56	34	59	56	79	9.04	+6.2	12	5,467	e.	32	e.	12	10	10	11	5.2	0.0	0.0
Little Rock	357	136	144	29.61	29.98	−.08	65.8	+2.2	89	2	74	33	25	57	26	59	55	75	3.99	+1.4	9	6,172	e.	35	s.	28	16	4	11	4.6	0.0	0.0
Brownsville	57	53	61	29.84	29.90	----	79.6	+4.7	92	15	88	58	31	72	23	72	70	82	2.68	----	5	5,395	s.	44	n.	20	16	13	2	3.9	0.0	0.0
Corpus Christi	20	11	73	29.92	29.94	−.06	78.2	+5.0	92	11	85	61	31	72	20	71	69	79	3.93	+1.9	13	9,187	se.	38	nw.	22	14	14	3	3.7	0.0	0.0
Dallas	512	220	227	29.42	29.96	----	70.1	----	90	3	79	46	31	61	37	----	----	----	2.01	----	11	9,235	se.	43	se.	3	12	12	7	4.2	0.0	0.0
Fort Worth	670	106	114	29.24	29.94	−.09	71.2	+4.5	94	3	81	46	31	62	40	62	56	70	3.16	+0.5	4	6,683	s.	34	s.	3	11	13	7	4.8	0.0	0.0
Galveston	54	106	114	29.92	29.98	−.05	76.7	+4.0	87	4	81	60	31	72	16	69	66	74	2.02	−2.2	8	8,759	s.	39	nw.	23	13	14	4	4.2	0.0	0.0
Groesbeck	461	11	56	29.48	29.96	----	71.6	----	93	11	81	43	25	62	33	----	----	----	4.11	----	11	7,189	se.	40	ne.	12	8	13	10	5.6	0.0	0.0
Houston	138	292	314	29.83	29.97	----	74.8	+4.9	91	10	82	54	31	67	25	----	----	----	4.96	----	7	9,834	se.	40	nw.	23	10	15	8	4.9	0.0	0.0
Palestine	510	64	72	29.45	29.95	−.05	71.4	+4.2	91	3	80	45	25	62	32	63	59	74	2.03	−1.6	11	5,415	se.	30	s.	22	9	13	9	5.4	0.0	0.0
Port Arthur	34	58	66	29.93	29.97	----	75.1	----	91	11	82	52	25	68	23	----	----	----	3.01	----	7	5,501	se.	29	nw.	23	16	6	9	4.2	0.0	0.0
San Antonio	693	119	132	29.23	29.94	−.07	75.2	+4.7	96	11	85	51	25	66	30	65	61	70	1.82	+0.3	5	5,705	ne.	34	n.	11	10	14	7	5.1	0.0	0.0
Taylor	583	55	63	29.38	29.99	−.03	72.4	+4.1	94	10	82	46	25	63	33	----	----	----	3.66	+1.1	10	5,992	se.	29	s.	28	10	15	6	4.7	0.0	0.0

TABLE 1.—*Climatological data for Weather Bureau Stations, October, 1926*—Continued

Districts and stations	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max. + mean min. ÷ 2	Temperature: Departure from normal	Temperature: Maximum	Date	Mean maximum	Minimum	Date	Mean minimum	Greatest daily range	Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Days with 0.01, or more	Wind: Total movement	Wind: Prevailing direction	Maximum velocity: Miles per hour	Maximum velocity: Direction	Maximum velocity: Date	Clear days	Partly clouded days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
Ohio Valley and Tennessee	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	In.	In.		Miles.								0-10	In.	In.
							57.7	0.0										80	4.32	+1.8										6.2		
Chattanooga	762	189	213	29.20	30.01	−.08	62.4	+0.5	89	1	72	35	25	53	33	56	52	76	2.10	−0.7	11	4,094	w.	30	w.	24	12	10	9	5.1	T.	0.0
Knoxville	995	102	111	28.96	30.01	−.08	60.8	+0.9	89	1	70	34	26	52	32	55	52	80	2.88	+0.3	8	3,802	sw.	26	w.	24	12	8	11	5.2	0.0	0.0
Memphis	399	76	97	29.57	29.99	−.08	65.3	+2.0	91	3	74	32	25	57	25	58	54	74	3.64	+0.9	8	5,148	sw.	34	n.	20	15	5	11	4.6	0.0	0.0
Nashville	546	168	191	29.44	30.02	−.06	62.4	+1.4	89	1	71	36	25	54	29	56	53	78	4.64	+2.2	11	5,558	s.	32	nw.	24	12	9	10	5.3	0.0	0.0
Lexington	989	193	230	28.93	30.00	−.08	57.2	−0.2	85	1	65	32	25	49	25	-----	-----	-----	7.46	+5.2	16	8,971	sw.	36	sw.	28	11	12	8	5.0	T.	0.0
Louisville	525	188	234	29.42	30.00	−.08	58.5	−0.8	87	1	67	33	27	50	26	53	50	79	6.15	+3.5	11	7,192	s.	37	s.	4	6	16	9	5.8	T.	0.0
Evansville	431	76	116	29.54	30.01	−.07	59.7	+0.3	88	1	68	36	25	51	27	53	50	76	4.03	+0.9	11	5,926	s.	37	sw.	28	7	16	8	5.9	T.	0.0
Indianapolis	822	194	230	29.09	29.98	−.09	55.2	−0.5	85	3	63	32	25	47	23	49	46	77	2.68	−0.1	14	7,818	sw.	40	nw.	5	5	16	10	6.4	T.	0.0
Royal Center	736	11	55	29.16	29.96	-----	51.2	-----	85	3	60	27	27	42	26	-----	-----	-----	4.55	-----	16	6,436	sw.	29	sw.	4	4	12	15	7.1	T.	0.0
Terre Haute	575	96	120	29.36	29.97	-----	55.9	-----	87	3	64	31	27	48	26	50	47	80	4.36	-----	14	6,462	s.	31	w.	2	3	16	12	6.4	T.	0.0
Cincinnati	627	11	51	29.31	29.99	−.09	55.7	0.0	86	3	65	29	27	47	28	51	48	81	4.49	+2.2	12	4,540	sw.	23	nw.	24	7	9	15	6.5	T.	0.0
Columbus	822	179	222	29.10	29.98	−.10	54.0	−1.2	85	4	62	32	25	46	29	50	48	84	4.50	+2.2	16	6,604	s.	36	nw.	16	3	6	22	8.1	T.	0.0
Dayton	899	137	173	29.00	29.96	-----	54.9	−0.1	85	3	63	31	27	47	28	50	47	80	5.46	+3.1	16	6,040	sw.	38	w.	5	6	10	15	6.6	T.	0.0
Elkins	1,947	59	67	27.96	30.02	−.08	52.3	0.0	84	4	62	25	28	43	44	47	46	90	4.15	+1.7	15	3,530	w.	21	sw.	24	1	12	18	7.6	T.	0.0
Parkersburg	637	77	82	29.35	30.01	−.07	56.0	−0.1	87	4	64	35	25	48	31	50	48	81	4.18	+1.7	11	3,680	se	22	nw.	25	7	5	19	7.2	T.	0.0
Pittsburgh	842	353	410	29.07	29.96	−.10	53.5	−2.2	84	4	61	30	26	46	27	49	46	80	4.12	+1.8	19	7,586	w.	40	nw.	18	4	12	15	6.7	T.	0.0
Lower Lake Region							50.1	−2.1										78	4.80	+1.8										7.2		
Buffalo	767	247	280	29.09	29.92	−.13	49.3	−2.6	81	4	55	33	26	43	22	47	45	88	6.16	+2.6	17	11,102	sw.	56	w.	25	1	12	18	7.8	T.	0.0
Canton	448	10	61	29.43	29.91	-----	45.4	−1.8	83	4	54	24	18	37	39	-----	-----	-----	4.63	+1.3	17	6,344	sw.	38	sw.	16	6	8	17	7.1	5.8	0.0
Oswego	335	76	91	-----	29.92	−.13	48.0	−3.2	85	4	55	32	23	41	28	-----	-----	78	4.56	+1.2	19	7,289	s.	31	nw.	25	4	11	16	-----	T.	0.0
Rochester	523	86	102	29.36	29.94	−.11	49.0	−2.5	89	4	56	33	31	42	30	45	41	77	4.42	+1.6	20	5,419	sw.	30	w.	25	2	5	24	8.3	T.	0.0
Syracuse	597	97	113	29.30	29.94	−.12	48.4	−2.6	83	4	55	33	20	42	25	-----	-----	-----	3.44	+0.2	18	5,197	s.	36	s.	2	6	6	19	7.3	0.6	0.0
Erie	714	130	166	29.16	29.93	−.12	51.2	−2.2	86	4	58	31	26	45	25	47	42	74	7.98	+4.2	22	9,919	s.	38	w.	20	3	12	16	7.3	1.9	0.0
Cleveland	762	190	201	29.13	29.96	−.10	52.2	−1.4	85	4	59	33	26	46	26	48	45	79	6.75	+4.0	21	10,312	s.	47	n.	24	3	9	19	7.5	T.	0.0
Sandusky	629	62	70	29.28	29.96	−.10	52.5	−1.8	84	4	59	30	27	46	25	-----	-----	-----	4.08	+1.6	16	6,191	sw.	35	n.	1	4	12	15	7.0	T.	0.0
Toledo	628	208	243	29.28	29.97	−.08	52.1	−1.3	84	4	60	31	27	44	27	47	43	77	2.92	+0.7	15	8,787	sw.	44	w.	18	7	11	13	6.2	T.	0.0
Fort Wayne	856	113	124	29.03	29.96	-----	52.4	−1.3	85	3	60	30	27	44	25	47	44	80	3.35	-----	14	6,000	sw.	38	s.	4	4	15	12	6.5	T.	0.0
Detroit	730	218	258	29.17	29.96	−.09	50.6	−1.9	82	4	57	31	26	44	22	45	40	73	3.11	+0.7	16	6,927	w.	42	sw.	4	5	9	17	7.0	T.	0.0
Upper Lake Region							46.0	−2.6										78	3.00	+0.2										7.4		
Alpena	609	13	92	29.23	29.90	−.13	44.6	−2.5	82	4	52	24	31	37	25	41	37	80	1.75	−1.7	15	8,627	nw.	44	s.	4	4	9	18	7.3	1.7	0.0
Escanaba	612	54	60	29.22	29.90	−.11	43.2	−2.8	71	2	50	20	31	36	23	39	35	76	4.04	+1.0	14	7,389	nw.	35	ne.	18	6	12	13	6.3	0.1	T.
Grand Haven	632	54	89	29.24	29.92	−.11	48.8	−1.9	79	3	55	28	31	42	25	45	41	77	3.47	+1.0	19	8,402	w.	37	w.	22	1	11	19	8.0	T.	T.
Grand Rapids	707	70	87	29.17	29.94	−.10	49.4	−1.8	80	3	57	30	31	42	25	44	41	77	3.04	+0.5	15	4,101	w.	23	nw.	22	1	4	26	8.6	T.	0.0
Houghton	668	62	99	29.13	29.86	−.14	42.2	−3.5	74	4	48	28	31	36	30	-----	-----	-----	4.26	+1.1	17	8,238	w.	46	w.	4	2	7	22	8.2	11.2	0.0
Lansing	878	11	62	29.00	29.95		48.0	−2.3	83	4	57	25	26	39	33	44	42	87	2.24	0.0	16	4,039	nw.	21	s.	4	2	18	11	6.8	T.	0.0
Ludington	637	60	66	29.21	29.91	-----	48.1	-----	75	3	54	33	31	42	26	44	40	76	4.11	-----	19	8,796	s.	36	s.	4	5	8	18	6.8	0.2	0.2
Marquette	734	77	111	29.07	29.88	−.13	43.0	−3.7	74	4	50	29	31	36	29	39	36	80	2.88	−0.3	16	7,522	w.	52	sw.	4	2	4	25	8.6	5.9	0.0
Port Huron	638	70	120	29.24	29.94	−.10	48.0	−2.5	82	4	55	29	26	41	23	44	41	79	3.08	+0.4	15	7,875	nw.	35	n.	18	2	16	13	6.6	T.	0.0
Saginaw	641	-----	-----	-----	-----	-----	46.9	−3.4	85	4	56	25	31	38	27	-----	-----	-----	3.04	-----	14	-----	sw.	-----	-----	-----	2	7	22	-----	T.	0.0
Sault Sainte Marie	614	11	52	29.19	29.89	−.12	41.6	−3.0	78	4	48	26	8	35	26	39	36	83	4.35	+1.1	20	6,835	nw.	39	nw.	14	3	3	25	8.4	6.4	0.0
Chicago	673	7	131	29.22	29.95	−.09	52.4	−1.6	85	3	59	32	27	46	22	47	43	74	1.67	−0.9	12	7,732	nw.	34	sw.	4	4	11	16	7.1	T.	0.0
Green Bay	617	109	141	29.28	29.90	−.12	46.0	−2.5	75	1	54	25	31	38	24	42	38	80	2.76	+0.4	15	7,856	s.	50	sw.	4	3	11	17	7.5	T.	0.0
Milwaukee	681	125	139	29.18	29.92	−.11	49.3	−1.8	77	1	56	28	26	42	21	44	40	71	2.72	+0.3	14	6,927	w.	36	sw.	4	4	9	18	7.1	0.4	T.
Duluth	1,133	5	47	28.65	29.80	−.11	40.7	−3.4	70	2	48	18	31	33	28	36	33	80	2.81	+0.1	11	9,282	w.	43	nw.	11	7	8	16	6.6	7.0	2.5
North Dakota							43.1	−0.2										73	1.03	−0.2										6.3		
Moorhead	940	50	58	28.86	29.89	−.11	43.0	−1.5	72	8	52	17	30	33	30	38	34	77	2.22	+0.2	10	6,736	nw.	31	w.	1	3	10	18	7.1	1.8	0.9
Bismarck	1,674	8	57	28.14	29.95	−.04	45.0	+0.1	75	10	57	13	30	33	30	38	32	68	0.23	−0.8	5	7,809	nw.	39	nw.	25	5	18	8	5.8	T.	0.0
Devils Lake	1,478	11	44	28.29	29.88	−.11	40.4	−0.1	66	9	50	15	30	31	35	35	32	79	0.97	−0.3	12	7,513	nw.	42	nw.	17	5	10	16	6.8	0.7	T.
Ellendale	1,457	10	56	28.32	29.90	-----	45.0	-----	74	15	56	17	30	34	38	-----	-----	-----	1.78	-----	8	10,169	nw.	48	nw.	19	3	19	9	6.1	0.1	0.0
Grand Forks	833	12	67	-----	-----		42.0	-----	69	8	52	19	30	32	37	36	-----	-----	4.03	-----	13	-----	nw.	44	nw.	4	6	11	14	-----	8.2	T.
Williston	1,878	41	48	27.91	29.91	−.07	44.0	+0.6	73	6	55	18	23	33	35	38	33	69	0.71	−0.1	7	6,894	nw.	41	nw.	1	9	14	8	5.5	1.8	0.0
Upper Mississippi Valley							52.2	−1.0										76	2.52	+0.1										6.4		
Minneapolis	918	102	208	28.80	29.88	-----	47.2	−1.7	73	8	55	23	30	39	27	-----	-----	-----	1.61	−1.0	10	8,288	nw.	36	nw.	18	6	9	16	6.4	0.1	T.
St. Paul	837	236	261	28.98	29.89	−.12	46.8	−1.8	72	9	55	23	30	39	30	-----	-----	-----	2.35	0.0	10	9,224	nw.	48	nw.	18	7	10	14	6.2	0.3	T.
La Crosse	714	11	48	29.13	29.91	−.11	48.0	−2.3	72	8	57	24	24	39	31	-----	-----	-----	1.73	−0.7	11	3,645	se.	21	s.	4	6	11	14	6.8	2.4	T.
Madison	974	70	78	28.89	29.94	−.09	48.2	−2.1	77	1	56	28	26	40	28	43	39	75	2.83	+0.4	14	6,156	nw.	33	sw.	4	4	11	16	7.3	3.2	0.2
Wausau	1,247	4	-----	28.56	29.90	-----	43.6	-----	78	1	52	22	31	36	31	-----	-----	-----	2.89	-----	13	-----	s.	-----	-----	-----	8	6	17	7.1	2.0	T.
Charles City	1,015	10	49	28.86	29.94	−.08	47.7	−0.9	76	8	57	25	30	38	34	42	39	78	1.08	−1.0	9	4,852	nw.	26	sw.	4	8	12	11	5.6	T.	0.0
Davenport	606	71	79	29.29	29.95	−.09	52.4	−1.3	85	3	60	29	24	44	28	48	44	76	2.38	0.0	8	4,482	nw.	25	s.	3	5	11	15	7.2	T.	0.0
Des Moines	861	84	97	29.03	29.94	−.09	53.0	−0.4	80	3	62	26	25	44	30	47	42	70	0.73	−2.0	6	5,067	sw.	31	sw.	4	7	7	17	6.7	0.0	0.0
Dubuque	700	81	96	29.16	29.92	−.12	49.9	−2.0	78	3	58	28	24	41	26	45	41	75	1.48	−1.2	9	4,515	nw.	24	nw.	16	3	11	17	7.3	0.4	0.0
Keokuk	614	64	78	29.30	29.97	−.08	54.2	−1.2	85	3	62	28	25	46	33	49	45	73	3.41	+0.9	11	4,839	s.	28	s.	3	7	10	14	6.5	0.0	0.0
Cairo	358	87	93	29.61	29.99	−.08	61.2	+0.8	88	2	69	33	25	53	25	55	51	78	3.43	+0.8	12	5,758	s.	29	n.	30	11	10	10	5.5	0.0	0.0
Peoria	609	11	45	29.31	29.98	−.07	52.5	+0.5	86	3	61	28	31	44	30	48	45	82	2.62	0.0	10	3,917	s.	19	nw.	16	6	11	14	6.3	0.0	0.0
Springfield, Ill	636	10	91	29.30	29.98	−.07	55.3	−0.5	86	3	63	32	31	47	26	50	46	78	4.87	+2.3	10	5,658	s.	23	s.	3	9	6	16	6.2	0.0	0.0
Hannibal	534	74	109	29.39	29.97	−.08	55.4	−0.6	86	3	64	29	25	47	34	-----	-----	-----	2.95	+1.3	9	5,754	sw.	36	nw.	3	11	7	13	5.5	0.0	0.0
St. Louis	568	265	303	29.37	29.98	−.08	58.4	+0.1	87	1	66	33	25	50	31	52	48	76	3.84	+1.4	13	8,341	sw.	37	sw.	27	13	9	9	5.1	0.0	0.0
Missouri Valley							54.6	+0.9										68	2.60	+0.7										4.7		
Columbia, Mo	784	11	84	29.13	29.97	−.08	55.9	−0.7	85	3	65	27	25	47	33	-----	-----	-----	3.72	+1.8	11	5,110	s.	24	s.	3	12	6	13	5.4	0.0	0.0
Kansas City	963	161	181	28.93	29.97	−.07	57.5	−0.2	80	3	65	31	24	50	30	51	46	71	4.27	+2.1	10	7,402	s.	30	nw.	5	14	5	12	5.2	0.0	0.0
St. Joseph	967	11	49	28.92	29.96	-----	56.6	-----	80	3	65	28	24	48	29	50	45	73	4.82	-----	8	5,231	nw.	36	nw.	1	15	8	8	4.3	0.0	0.0
Springfield, Mo	1,324	98	104	28.57	29.97	−.08	58.2	0.0	84	1	67	28	25	50	29	52	49	78	4.14	+1.3	10	7,434	s.	31	s.	3	13	11	7	4.5	0.0	0.0
Iola	984	11	50	28.91	29.96	−.08	58.4	+0.6	81	17	68	29	25	48	40	-----	-----	-----	6.13	+3.4	8	4,485	s.	20	s.	3	12	7	12	5.5	0.0	0.0
Topeka	987	92	107	-----	-----		57.7	+0.7	81	17	66	28	24	49	32	-----	-----	-----	4.90	+3.0	7	6,403	n.	27	s.	8	17	8	6	3.6	0.0	0.0
Lincoln	1,189	11	84	28.69	29.95	−.08	54.8	+0.6	80	15	65	25	24	45	33	48	42	68	0.90	−0.9	6	6,601	s.	32	sw.	3	11	6	14	5.5	0.0	0.0
Omaha	1,105	115	122	28.77	29.95	−.08	55.1	+0.8	79	27	64	26	24	46	32	47	40	63	0.23	−2.1	3	4,540	nw.	25	n.	11	13	11	7	4.4	0.0	0.0
Valentine	2,598	47	54	27.25	29.97	−.04	51.6	+2.3	87	7	65	18	24	38	43	42	34	60	0.89	−0.4	4	7,687	w.	41	nw.	25	15	12	4	3.7	T.	0.0
Sioux City	1,135	94	164	28.74	29.96	−.06	52.7	+1.8	80	17	63	23	24	43	33	45	39	65	0.29	−1.5	6	8,822	nw.	37	s.	13	9	13	9	5.2	0.0	0.0
Huron	1,306	59	74	28.55	29.96	−.05	49.4	+1.7	78	15	61	20	30	38	37	42	37	71	2.76	+1.4	9	7,332	nw.	35	nw.	1	14	12	5	4.1	T.	0.0
Pierre	1,572	70	75	-----	29.94	−.07	51.4	+1.6	85	7	64	22	30	39	43	-----	-----	65	2.61	+1.8	7	7,091	nw.	36	nw.	15	9	16	6	-----	T.	0.0
Yankton	1,233	49	57	28.62	29.94	−.07	52.2	+1.1	83	17	64	22	24	40	36	-----	-----	-----	0.32	−1.2	8	5,675	w.	30	w.	21	9	14	8	5.2	0.0	0.0

TABLE 1.—*Climatological data for Weather Bureau Stations, October, 1926*—Continued

Districts and stations	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max. + mean min. ÷ 2	Temperature: Departure from normal	Temperature: Maximum	Temperature: Date	Temperature: Mean maximum	Temperature: Minimum	Temperature: Date	Temperature: Mean minimum	Temperature: Greatest daily range	Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01, or more	Wind: Total movement	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly clouded days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	In.	In.		Miles.								0-10	In.	In.
Northern Slope							48.4	+3.1										60	0.61	-0.3										5.2		
Billings	3,140	5	-----				50.9	-----	81	16	65	22	9	37	48				0.03	-----	1		nw.				13	8	10		0.0	0.0
Havre	2,505	11	44	27.30	29.95	-.03	48.1	+3.6	76	14	61	25	23	36	46	40	33	60	0.04	-0.5	3	5,502	sw.	40	w.	14	6	18	7	5.8	T.	0.0
Helena	4,110	87	112	25.80	30.00	-.03	49.4	+4.5	76	16	59	29	29	40	36	40	32	55	0.06	-0.8	2	5,956	sw.	36	sw.	25	4	13	14	6.6	T.	0.0
Kalispell	2,973	48	56	26.94	30.00	-.01	46.2	+2.7	63	5	56	24	29	37	28	41	36	72	0.67	-0.5	10	3,633	nw.	29	sw.	16	10	8	13	5.7	0.0	0.0
Miles City	2,371	48	55	27.44	30.01	+.01	50.2	+3.7	78	14	62	27	24	38	41	42	34	59	0.17	-0.6	4	5,030	nw.	30	nw.	17	8	17	6	5.1	T.	0.0
Rapid City	3,259	50	58	26.58	30.00	-.01	50.8	+2.3	83	7	64	22	24	38	43	41	32	54	0.55	-0.6	5	5,937	w.	36	nw.	25	10	11	10	5.4	0.7	0.0
Cheyenne	6,088	84	101	24.01	29.97	-.04	47.0	+2.2	79	17	61	8	30	33	38	37	28	53	1.22	+0.5	6	9,133	w.	40	w.	13	13	13	5	4.3	7.0	0.8
Lander	5,372	60	68	24.66	30.03	-.01	47.2	+3.7	76	16	61	19	30	33	43	37	28	54	0.51	-0.5	3	3,479	sw.	34	sw.	7	13	15	3	4.2	2.8	0.0
Sheridan	3,790	10	47	26.09	30.01	-----	47.5	-----	82	7	62	24	30	33	47	39	32	63	0.95	-----	11	3,703	nw.	29	nw.	24	8	17	6	5.6	0.5	0.0
Yellowstone Park	6,241	11	48	23.91	30.06	+.04	42.0	+0.5	66	16	54	17	30	30	36	36	32	71	1.42	+0.3	7	5,098	s.	39	s.	10	6	15	10	5.5	3.4	0.0
North Platte	2,821	11	51	27.06	29.99	-.03	54.7	+5.0	89	17	68	28	24	41	45	44	36	62	0.83	-0.3	5	5,019	n.	39	nw.	25	20	4	7	3.4	T.	0.0
Middle Slope							58.2	+2.3										62	1.87	+0.3										4.0		
Denver	5,292	106	113	24.74	29.98	-.03	53.6	+2.4	86	17	67	21	30	40	42	42	31	52	0.69	-0.3	5	5,405	s.	36	ne.	27	19	8	4	3.0	4.4	T.
Pueblo	4,685	80	86	25.29	29.96	-.03	54.4	+2.4	89	17	71	20	31	38	48	41	28	45	0.54	-0.2	3	4,487	nw.	30	ne.	23	20	8	3	2.9	4.3	T.
Concordia	1,392	50	58	28.49	29.96	-.07	57.8	+1.9	82	27	68	29	24	48	35	49	43	65	0.98	-1.0	3	5,273	s.	34	nw.	25	13	10	8	4.6	0.0	0.0
Dodge City	2,509	11	51	27.39	29.99	-.03	59.4	+3.3	94	17	73	29	31	46	45	48	41	62	0.10	-1.3	1	6,997	ne.	37	se.	2	22	5	4	2.7	0.0	0.0
Wichita	1,358	139	158	28.52	29.95	-.08	59.8	+1.2	82	17	68	34	24	52	40	53	48	72	5.68	+3.4	6	9,231	s.	39	s.	7	12	10	9	4.5	T.	0.0
Broken Arrow	765	11	56	29.14	29.96	-----	63.2	-----	88	1	72	33	25	54	35	-----	-----	-----	4.03	-----	7	8,926	s.	41	e.	12	10	8	13	5.4	0.0	0.0
Oklahoma City	1,214	10	47	28.68	29.96	-.07	64.0	+2.5	87	18	73	36	31	55	41	57	54	79	3.25	+1.4	4	7,039	s.	25	s.	8	12	9	10	4.7	0.0	0.0
Southern Slope							66.8	+3.7										68	2.88	+1.0										3.8		
Abilene	1,738	10	52	28.16	29.94	-.07	69.0	+3.6	95	11	80	44	31	58	39	59	54	68	2.22	-0.1	7	6,725	s.	31	s.	3	12	9	10	4.8	0.0	0.0
Amarillo	3,676	10	49	26.26	29.96	-.04	61.5	+3.8	87	10	73	33	31	50	40	51	46	70	2.15	+0.4	8	7,030	sw.	44	sw.	8	21	4	6	3.0	2.1	0.0
Del Rio	944	64	71	28.94	29.91	-.07	75.7	+5.7	95	12	84	51	31	67	29	-----	-----	-----	5.66	+3.7	5	6,217	se.	26	se.	3	13	11	7	4.6	0.0	0.0
Roswell	3,566	75	85	26.36	29.94	-.02	61.1	+1.6	88	27	74	34	30	48	49	52	46	67	1.50	+0.2	5	4,712	se.	39	ne.	23	17	10	4	3.0	T.	0.0
Southern Plateau							63.2	+3.2										68	0.59	0.0										1.9		
El Paso	3,778	152	175	26.18	29.92	.00	66.2	+2.7	86	12	77	44	31	55	34	54	45	55	0.89	-0.1	7	5,881	nw.	31	ne.	30	19	9	3	3.0	0.0	0.0
Santa Fe	7,013	38	53	23.28	29.94	-.02	52.8	+2.4	75	17	66	25	31	40	33	42	36	62	0.94	-0.1	4	4,077	se.	25	n.	2	22	6	3	2.5	T.	0.0
Flagstaff	6,907	10	59	23.38	29.92	.00	50.0	+5.3	75	17	66	26	24	34	45	39	-----	57	0.14	-----	4	5,818	nw.	26	sw.	20	26	5	0	-----	0.0	0.0
Phoenix	1,108	10	82	28.70	29.84	-.04	73.5	+2.9	96	17	89	48	25	58	43	58	48	48	0.07	-0.3	1	3,133	e.	22	s.	7	25	5	1	1.7	0.0	0.0
Yuma	141	9	54	29.68	29.82	-.05	75.2	+1.9	99	17	91	53	22	60	39	59	49	48	T.	-0.2	0	3,370	w.	21	n.	30	28	3	0	0.8	0.0	0.0
Independence	3,957	5	25	25.95	29.96	+.01	61.6	+4.1	87	16	79	36	30	44	43	44	-----	-----	1.03	+0.7	2	-----	nw.	-----	-----	-----	26	2	3	1.4	0.0	0.0
Middle Plateau							52.9	+2.7										44	0.32	-0.5										2.2		
Reno	4,532	74	81	25.50	30.00	+.01	53.4	+3.7	82	15	70	22	30	37	43	40	27	43	0.10	-0.2	1	3,986	w.	35	sw.	10	20	9	2	2.5	0.0	0.0
Tonopah	6,090	12	20	24.09	29.95	-----	54.4	-----	78	16	64	28	29	44	25	41	25	34	0.17	-----	2	-----	nw.	-----	-----	-----	-----	-----	-----	-----	-----	-----
Winnemucca	4,344	18	56	25.68	30.08	+.03	49.6	+1.3	84	16	69	12	30	30	52	39	28	50	0.05	-0.5	2	4,724	ne.	29	sw.	9	19	10	2	3.1	0.0	0.0
Modena	5,473	10	43	24.64	29.96	.00	51.6	+3.6	83	16	70	20	31	33	49	37	22	35	T.	-0.8	0	7,195	w.	52	sw.	7	26	3	2	1.1	0.0	0.0
Salt Lake City	4,360	163	203	25.66	30.03	+.02	54.8	+2.3	82	16	66	33	30	44	38	44	35	51	0.71	-0.7	3	4,561	se.	42	nw.	7	25	3	3	2.0	0.0	0.0
Grand Junction	4,602	60	68	25.40	29.97	-.02	55.2	+2.4	80	18	70	29	31	41	37	43	34	51	0.74	-0.2	4	3,621	se.	24	w.	8	24	3	4	2.2	0.0	0.0
Northern Plateau							52.1	+2.2										56	1.06	-0.1										4.7		
Baker	3,471	48	53	-----	30.10	+.02	48.1	+1.5	74	15	62	20	30	34	44	-----	-----	60	0.22	-0.7	5	4,376	se.	26	s.	10	13	7	11	-----	0.0	0.0
Boise	2,739	78	86	27.21	30.07	+.01	54.6	+3.5	81	16	68	28	30	42	36	43	30	43	0.01	-1.3	1	3,422	se.	23	se.	9	15	12	4	3.6	0.0	0.0
Lewiston	757	40	48	29.25	30.07	.00	52.5	+1.0	77	5	63	29	30	42	36	-----	-----	-----	2.36	+1.2	12	1,607	e.	19	nw.	7	13	2	16	5.6	0.0	0.0
Pocatello	4,477	60	68	25.52	30.04	.00	51.4	+3.0	82	16	64	23	30	39	37	40	30	49	0.43	-0.6	3	6,257	s.	36	sw.	10	17	8	6	3.6	0.0	0.0
Spokane	1,929	101	110	28.00	30.06	.00	50.4	+2.1	74	5	61	26	29	40	34	45	40	70	0.79	-0.4	10	3,642	s.	26	sw.	7	10	6	15	5.7	0.0	0.0
Walla Walla	991	57	65	28.97	30.04	-.03	55.8	+2.3	78	23	65	34	29	47	27	49	42	64	2.58	+1.1	10	2,851	s.	23	w.	7	14	4	13	5.1	0.0	0.0
North Pacific Coast Region							55.7	+3.6										81	4.79	+1.1										6.5		
North Head	211	11	56	29.77	29.99	-.06	56.2	+3.3	75	4	61	46	18	51	22	53	50	83	5.93	+2.0	19	11,383	s.	70	s.	10	9	0	22	7.2	0.0	0.0
Port Angeles	29	8	53	29.99	30.02	-----	51.2	-----	66	16	58	36	30	45	20	-----	-----	-----	3.04	+0.5	14	3,217	sw.	34	sw.	16	7	7	17	7.1	0.0	0.0
Seattle	125	215	250	29.88	30.01	-.04	55.0	+3.6	70	4	61	40	31	49	20	51	49	82	3.06	+0.4	18	5,941	se.	46	sw.	16	8	5	18	6.4	0.0	0.0
Tacoma	194	172	201	29.82	30.03	-.01	54.5	+4.0	70	15	62	36	28	48	21	-----	-----	-----	4.08	+0.9	18	5,136	s.	37	s.	14	3	12	16	7.3	0.0	0.0
Tatoosh Island	86	9	53	29.87	29.97	-.04	53.8	+3.9	61	15	56	48	8	51	9	52	50	90	9.38	+1.4	18	14,397	e.	65	sw.	16	8	5	18	6.7	0.0	0.0
Yakima	1,071	5	-----	-----	-----	-----	51.5	-----	76	5	67	20	30	36	45	-----	-----	-----	0.40	-----	5	-----	nw.	-----	-----	-----	10	14	7	5.1	0.0	0.0
Medford	1,425	4	-----	-----	-----	-----	55.6	-----	83	4	69	29	30	42	43	-----	-----	-----	2.62	-----	7	-----	nw.	-----	-----	-----	-----	-----	-----	-----	0.0	0.0
Portland, Oreg	153	68	106	29.86	30.02	-.04	57.8	+3.6	77	5	66	41	28	50	28	53	50	78	5.26	+2.0	17	3,624	nw.	22	s.	10	8	6	17	6.3	0.0	0.0
Roseburg	510	9	57	29.47	30.02	-.06	57.1	+3.2	82	5	68	32	30	46	36	52	48	73	2.78	+0.2	13	1,948	nw.	19	s.	14	8	11	12	6.1	0.0	0.0
Middle Pacific Coast Region							61.9	+2.5										69	1.76	+0.3										3.7		
Eureka	62	73	89	29.95	30.02	-.04	57.0	+3.4	75	15	64	40	30	50	24	54	52	86	3.49	+0.8	11	4,051	se.	32	sw.	9	9	7	15	6.1	0.0	0.0
Point Reyes	490	7	18	29.40	29.92	-----	56.8	+2.1	81	4	62	46	30	52	28	-----	-----	-----	1.61	-----	3	14,658	nw.	62	nw.	7	12	6	13	5.7	0.0	0.0
Red Bluff	332	50	56	29.60	29.95	-.08	66.6	+2.3	93	20	80	45	8	54	36	55	44	52	0.97	-0.6	3	4,569	nw.	20	se.	9	24	5	2	2.2	0.0	0.0
Sacramento	69	106	117	29.88	29.95	-.04	64.6	+1.7	87	5	76	45	30	53	32	56	48	60	2.14	+1.1	4	4,499	se.	24	nw.	29	26	3	2	1.5	0.0	0.0
San Francisco	155	208	243	29.80	29.97	-.04	63.4	+2.9	83	4	72	52	23	55	25	56	53	78	1.90	+0.6	4	4,479	w.	37	s.	9	15	13	3	3.5	0.0	0.0
San Jose	141	12	110	29.82	29.97	-----	63.0	+2.7	90	4	76	40	8	50	40	-----	-----	-----	0.31	-0.4	4	4,046	nw.	30	sw.	9	18	11	2	3.3	0.0	0.0
South Pacific Coast Region							65.7	+2.0										65	0.36	-0.4										2.3		
Fresno	327	89	98	29.59	29.95	-.01	66.8	+2.8	92	5	80	43	9	53	35	55	45	52	0.30	-0.4	2	3,751	nw.	28	nw.	7	28	1	2	1.1	0.0	0.0
Los Angeles	338	159	191	29.56	29.92	-.03	67.6	+2.3	97	5	78	51	26	57	33	57	50	66	0.27	-0.5	1	3,451	sw.	14	w.	20	19	12	0	2.2	0.0	0.0
San Diego	87	62	70	29.82	29.91	-.04	64.0	+0.3	90	5	70	51	25	58	27	58	55	78	0.21	-0.2	1	4,196	nw.	21	nw.	10	16	14	1	3.2	0.0	0.0
San Luis Obispo	201	32	40	29.74	29.96	-.03	64.4	+2.6	97	5	78	42	31	51	43	54	47	64	0.66	-0.7	1	2,927	n.	25	ne.	12	21	7	3	2.6	0.0	0.0
West Indies																																
San Juan, P. R	82	9	54	29.80	29.88	-----	79.9	+0.1	91	22	86	72	6	74	17	-----	-----	-----	8.32	+2.2	19	6,256	e.	40	e.	29	7	16	8	5.8	0.0	0.0
Panama Canal																																
Balboa Heights	118	7	97	-----	29.81	-----	79.5	-----	91	9	85	71	2	74	18	-----	-----	-----	9.93	-----	20	5,494	s.	54	s.	16	1	15	17	-----	0.0	0.0
Colon	38	7	97	-----	29.80	-----	81.8	-----	93	27	68	75	2	75	19	-----	-----	-----	15.51	-----	-----	5,005	se.	24	se.	17	1	10	20	-----	0.0	0.0
Alaska																																
Juneau	80	11	54	[1]29.65	[1]29.74	-----	45.8	-----	60	4	51	26	14	40	25	43	40	82	13.46	-----	20	5,702	s.	58	e.	14	6	4	21	7.4	3.8	0.0
Hawaiian Islands																																
Honolulu	38	86	100	[1]29.92	[1]29.96	-----	77.6	-----	85	1	83	69	20	72	14	71	68	73	1.93	+0.4	9	5,639	ne.	31	e.	17	4	19	8	5.5	0.0	0.0

[1] Pressure not corrected to mean of 24 hours

TABLE 2.—*Data furnished by the Canadian Meteorological Service, October, 1926*

Stations	Altitude above mean sea level, Jan. 1, 1919	Pressure			Temperature of the air						Precipitation		
		Station reduced to mean of 24 hours	Sea level reduced to mean of 24 hours	Departure from normal	Mean max.+mean min.÷2	Departure from normal	Mean maximum	Mean minimum	Highest	Lowest	Total	Departure from normal	Total snowfall
	Feet	*In.*	*In.*	*In.*	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*	*In.*	*In.*	*In.*
St. Johns, N. F	125												
Sydney, C. B. I	48	29.83	29.88	−0.08	48.5	+2.0	55.6	41.5	70	30	5.38	+0.69	0.0
Halifax, N. S	88	29.65	29.75	−.25	49.1	+1.9	56.2	42.0	71	32	6.75	+1.20	0.0
Yarmouth, N. S	65	29.78	29.85	−.17	48.0	+0.4	55.2	40.7	70	30	5.27	+0.57	0.2
Charlottetown, P. E. I	38	29.78	29.82	−.14	48.6	+2.1	54.3	42.9	70	31	3.77	−1.13	0.0
Chatham, N. B	28	29.73	29.76	−.20	44.3	+1.3	52.7	36.0	68	24	8.11	+4.25	0.0
Father Point, Que	20	29.78	29.80	−.15	42.6	+2.8	48.9	36.3	79	26	4.54	+1.64	0.0
Quebec, Que	296	29.54	29.86	−.14	44.0	+1.6	50.0	38.1	74	27	5.10	+1.95	0.2
Montreal, Que	187	29.66	29.87	−.14	45.5	+0.7	51.6	39.4	74	30	4.98	+1.85	0.6
Ottawa, Ont	236	29.63	29.89	−.12	45.5	+1.7	54.2	36.8	79	25	2.94	+0.39	1.8
Kingston, Ont	285	29.60	29.91	−.12	46.8	−0.2	52.8	40.8	75	30	5.52	+2.79	5.6
Toronto, Ont	379	29.50	29.91	−.13	47.2	+0.6	54.3	40.1	79	30	3.20	+0.84	0.1
Cochrane, Ont	930				38.6		45.0	32.2	74	22	1.60		3.0
White River, Ont	1,244	28.48	29.80	−.18	36.1	−1.0	44.5	27.7	67	12	2.78	+0.43	0.8
Southampton, Ont	656	29.19	29.91	−.11	45.5	−0.6	52.2	38.8	84	25	4.13	+0.96	1.6
Parry Sound, Ont	688	29.20	29.90	−.11	43.5	−0.4	50.1	36.9	82	23	4.41	+0.49	1.4
Port Arthur, Ont	644	29.14	29.85	−.13	38.7	−1.2	44.2	33.3	63	21	3.77	+1.21	4.5
Winnipeg, Man	760												
Minnedosa, Man	1,690	28.03	29.87	−.10	36.4	−1.4	43.9	28.9	62	8	2.55	+1.35	4.1
Le Pas, Man	860				34.6		42.0	27.2	64	5	2.20		4.0
Qu'Appelle, Sask	2,115	27.58	29.85	−.12	37.8	−1.6	46.5	29.2	70	10	2.20	+1.10	2.5
Medicine Hat, Alb	2,144	27.59	29.86	−.11	47.8	+3.0	58.5	37.1	76	25	0.02	−0.56	0.1
Moose Jaw, Sask	1,759				41.4		51.9	30.9	75	16	0.80		0.4
Swift Current, Sask	2,392	27.31	29.84	−.13	42.2	+0.1	53.4	31.1	72	11	0.62	−0.26	4.4
Calgary, Alb	3,428												
Banff, Alb	4,521	25.35	29.94	−.01	41.6	+2.3	51.0	32.1	65	21	0.68	−0.34	1.5
Edmonton, Alb	2,150	27.55	29.85	−.08	39.3	−1.8	48.7	29.9	77	15	0.58	−0.12	0.9
Prince Albert, Sask	1,450	28.30	29.90	−.07	37.9	+0.8	45.6	30.1	70	17	1.55	+0.72	8.3
Battleford, Sask	1,592	28.13	29.88	−.09	39.6	0.0	50.8	28.4	70	10	0.44	−0.01	0.2
Kamloops, B. C	1,262												
Victoria, B. C	230	29.75	30.00	−.01	52.7	+3.5	58.0	47.5	66	42	2.91	+0.54	0.0
Barkerville, B. C	4,180												
Prince Rupert, B. C	170												
Hamilton, Ber	151	29.88	30.04	+.02	73.8	+0.8	80.2	67.5	83	60	5.98	−0.73	0.0

...ticyclones, October, 1926. (Inset) Departure of Monthly Mean Pressure from Normal
(Plotted by Wilfred P. Day)

Chart II. Tracks of Centers of Cyclones, October, 1926. (Inset) Change in Mean Pressure from Preceding Month

(Plotted by Wilfred P. Day)

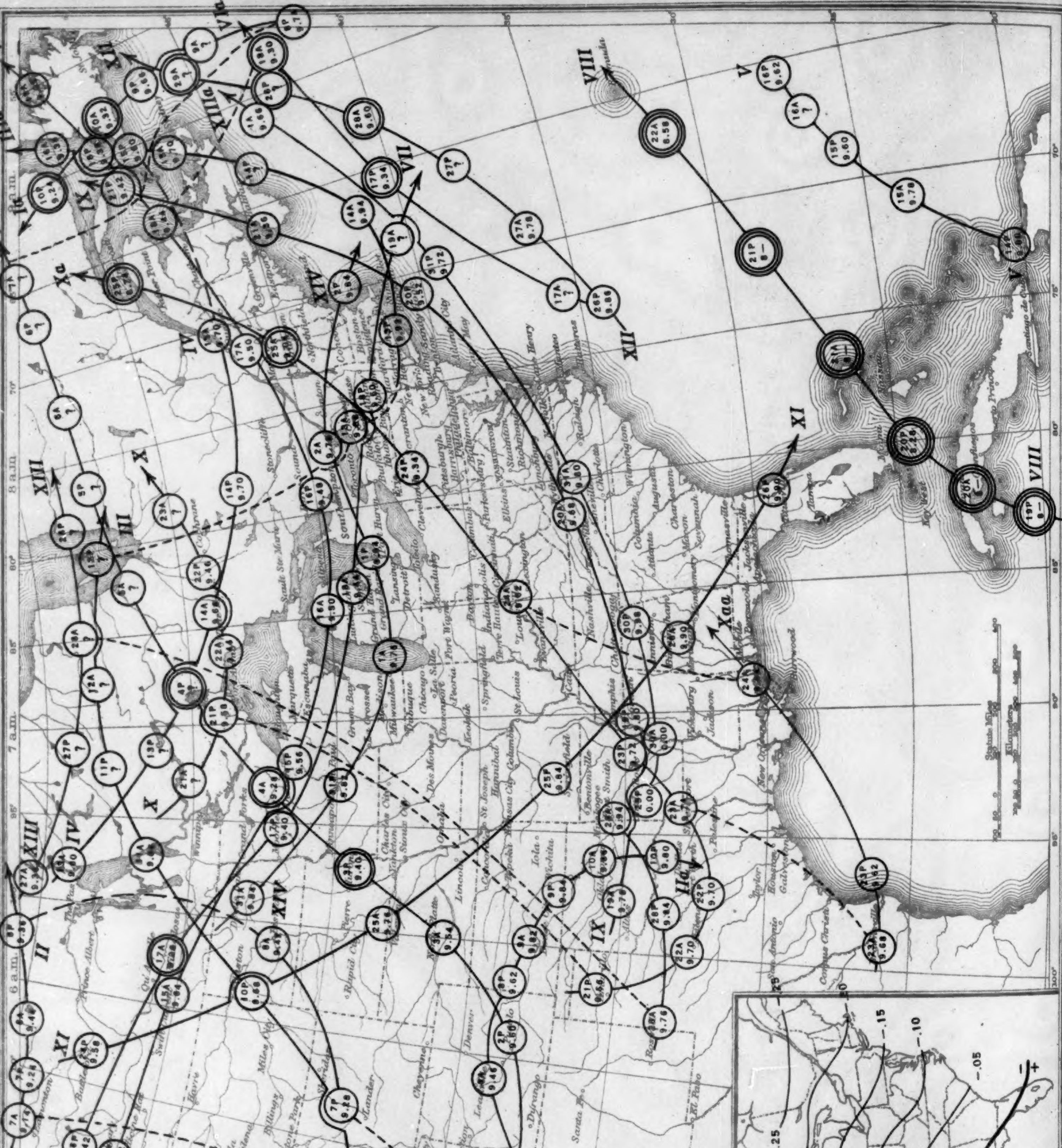

Chart III. Departure (°F.) of the Mean Temperature from the Normal, October, 1926

Chart IV. Total Precipitation, Inches, October, 1926. (Inset) Departure of Precipitation from Normal

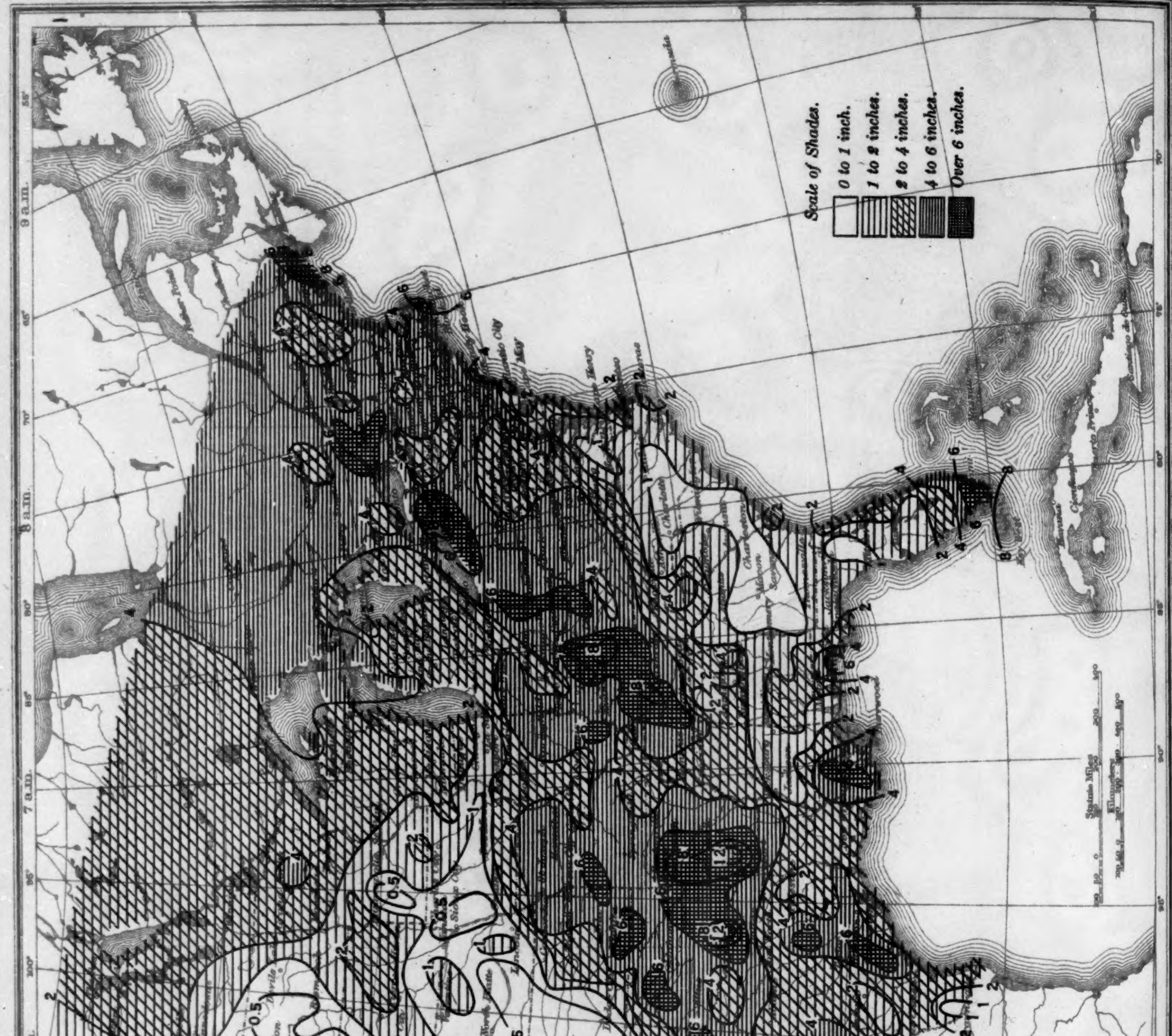

Chart V. Percentage of Clear Sky between Sunrise and Sunset, October, 1926

Chart VI. Isobars at Sea level and Isotherms at Surface; Prevailing Winds, October, 1926

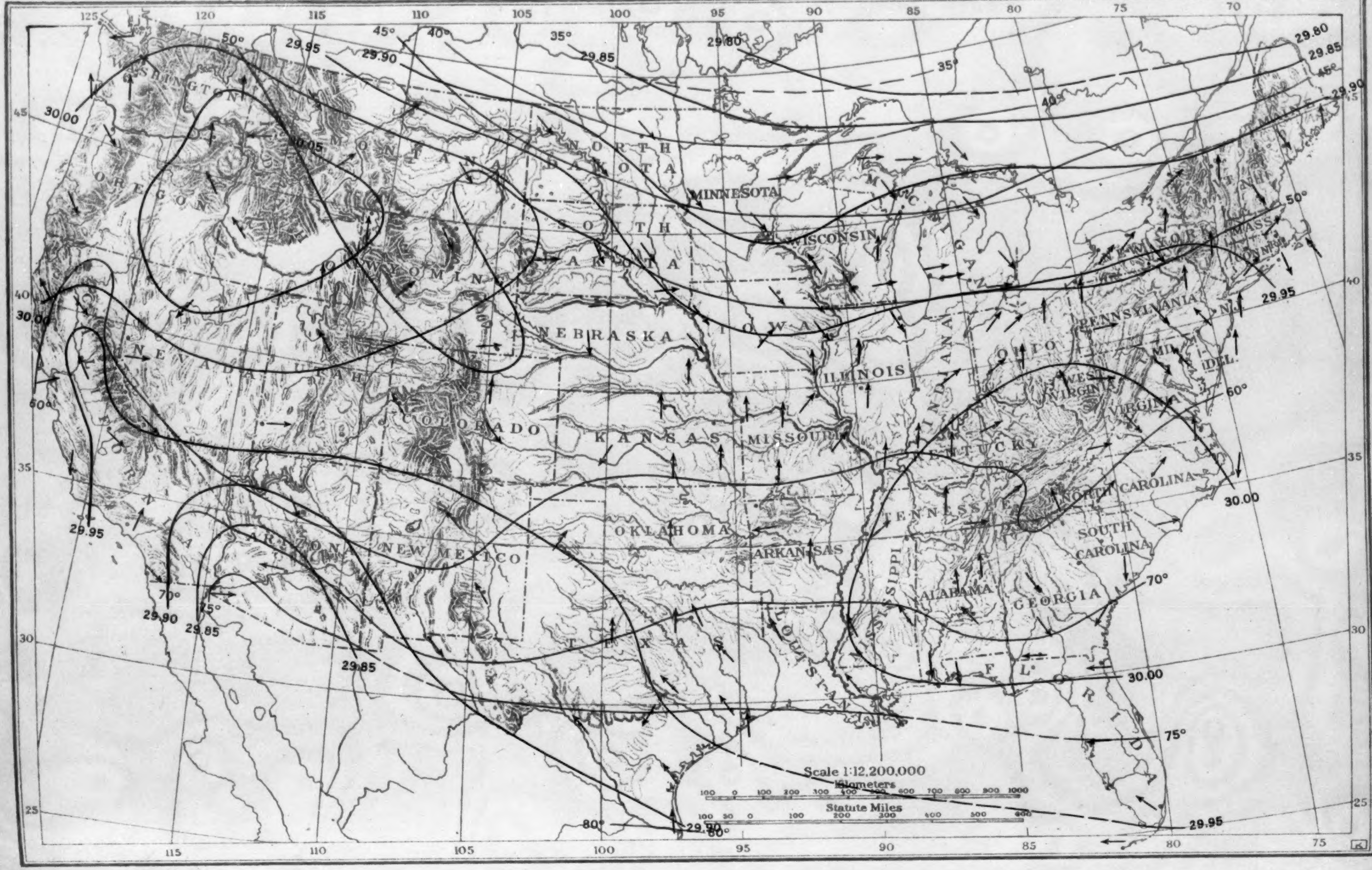

Chart VIII. Weather Map of North Atlantic Ocean, October 20, 1926
(Plotted by F. A. Young)

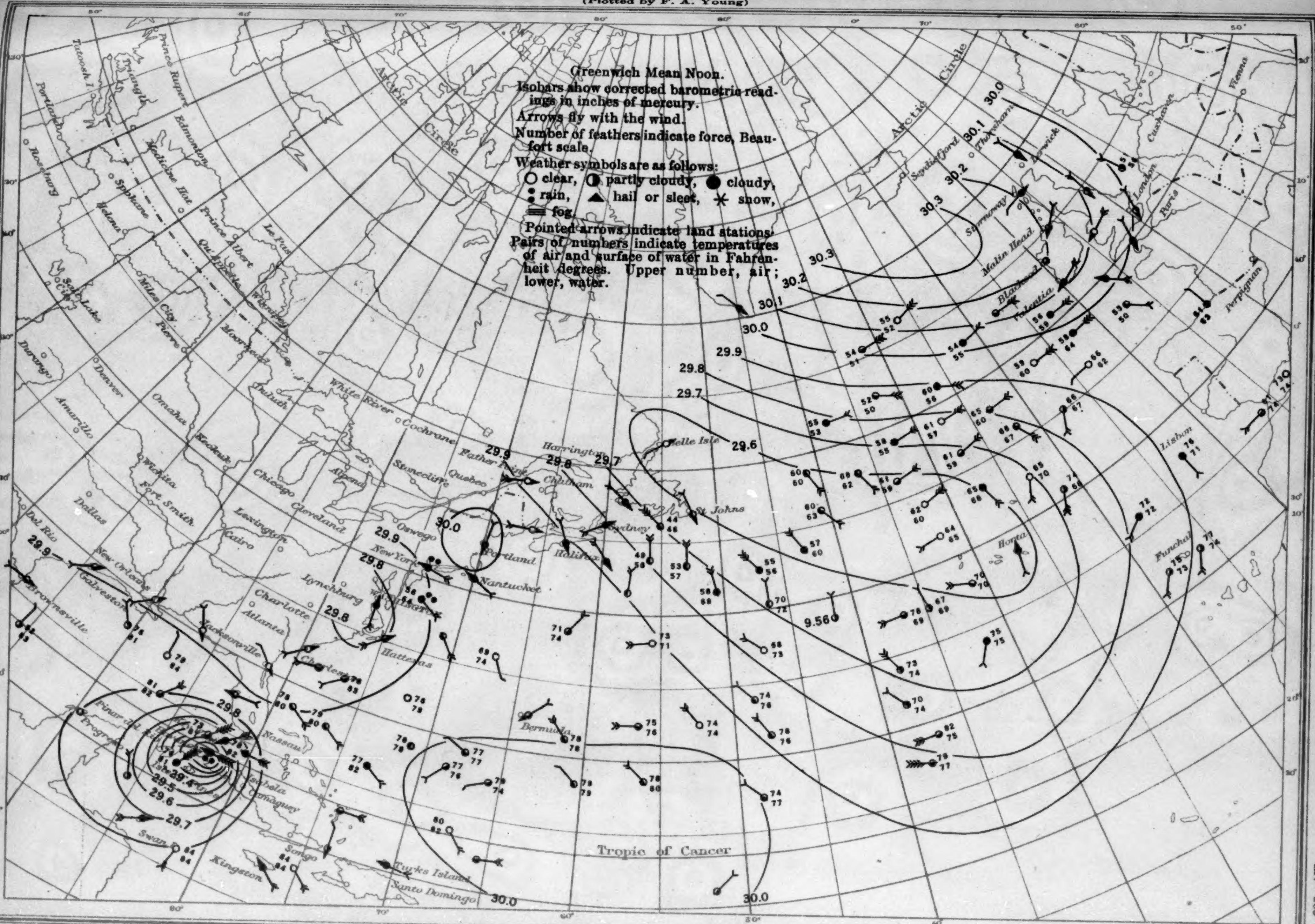

Chart IX. Weather Map of North Atlantic Ocean, October 21, 1926
(Plotted by F. A. Young)

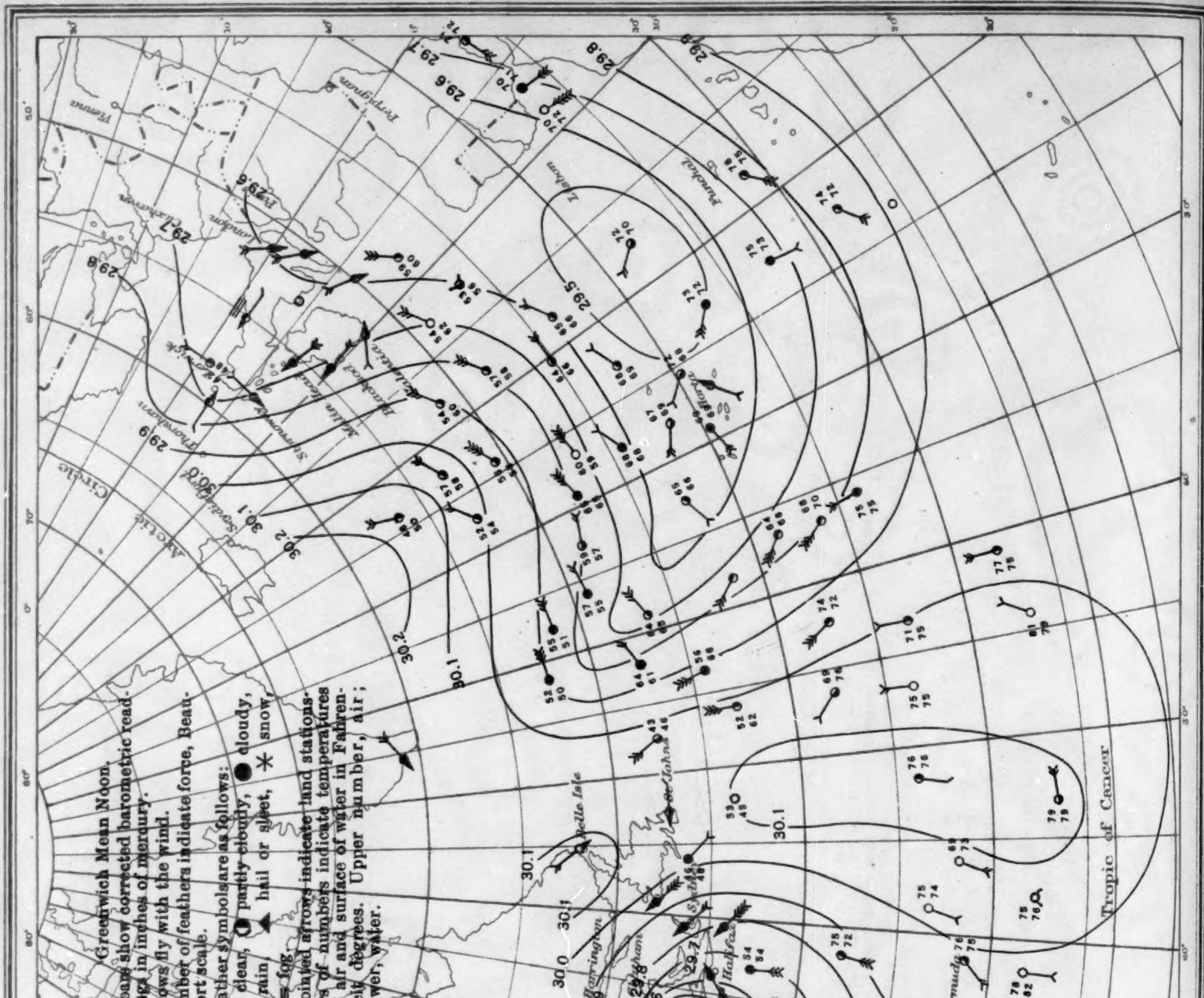

Chart I. Weather Map of North Atlantic Ocean, October 22, 1926
(Plotted by F. A. Young)

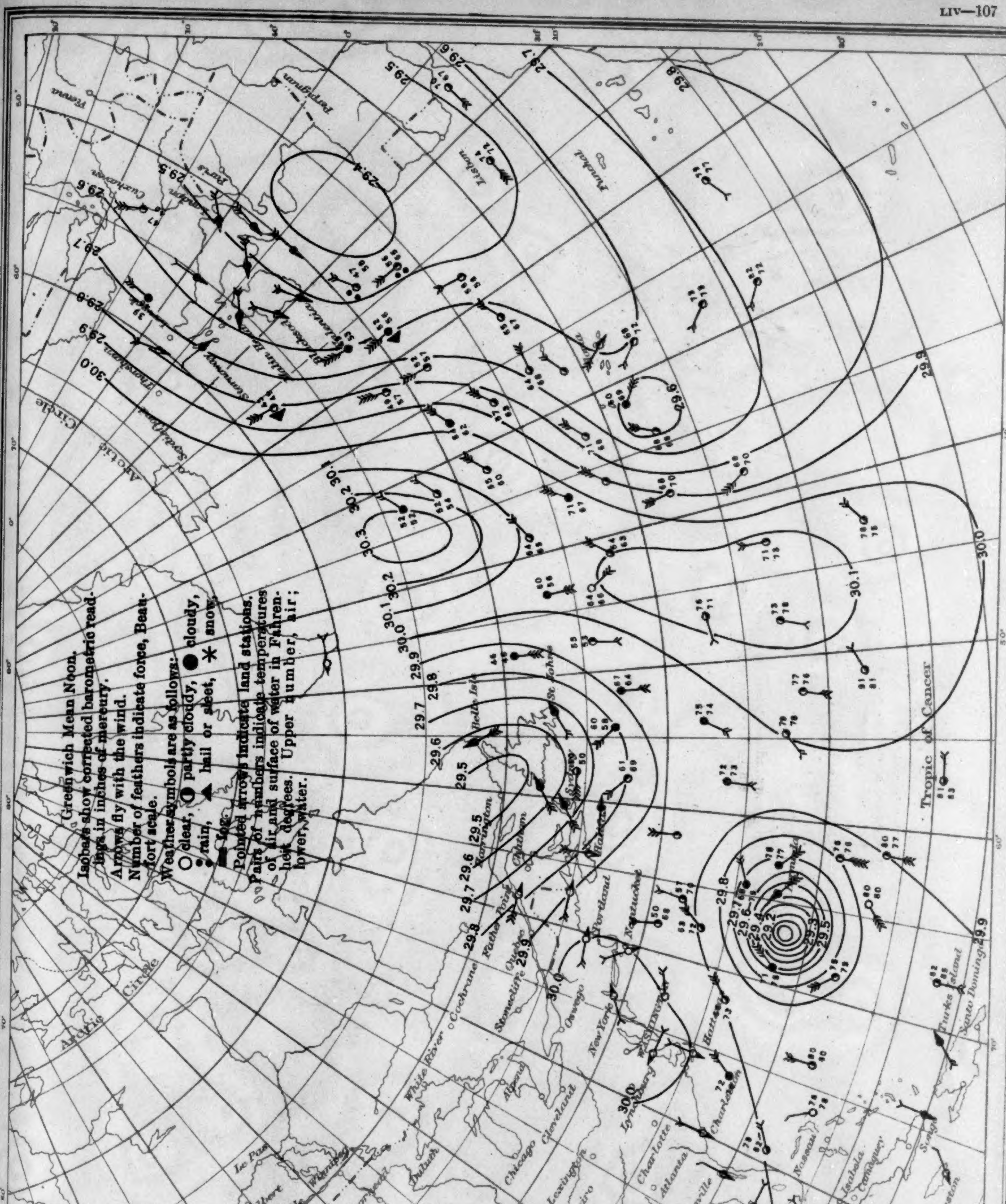

Chart XI. Weather Map of North Atlantic Ocean, October 23, 1926
(Plotted by F. A. Young)

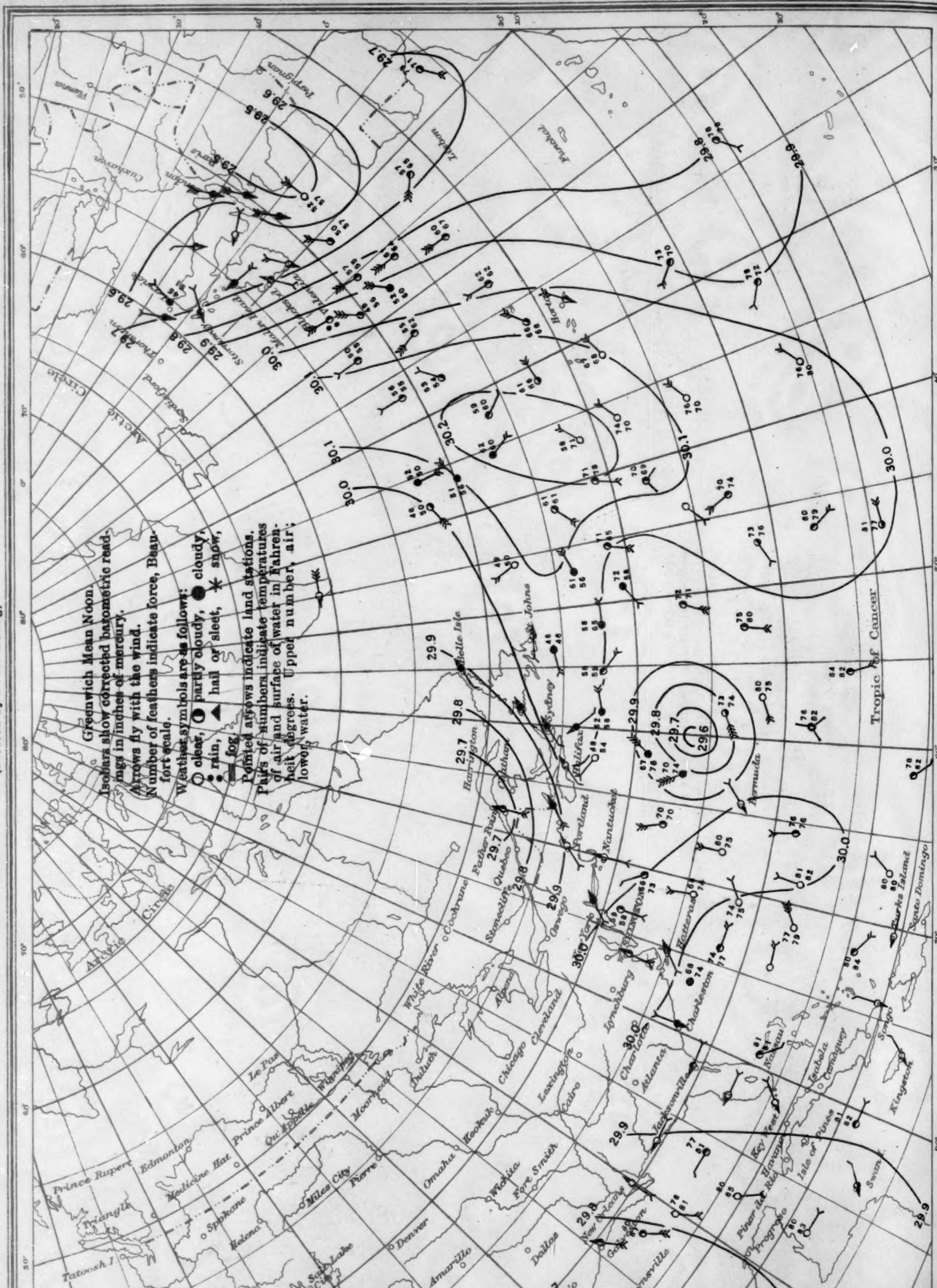

Chart XII. Weather Map of North Atlantic Ocean, October 24, 1926
(Plotted by F. A. Young)

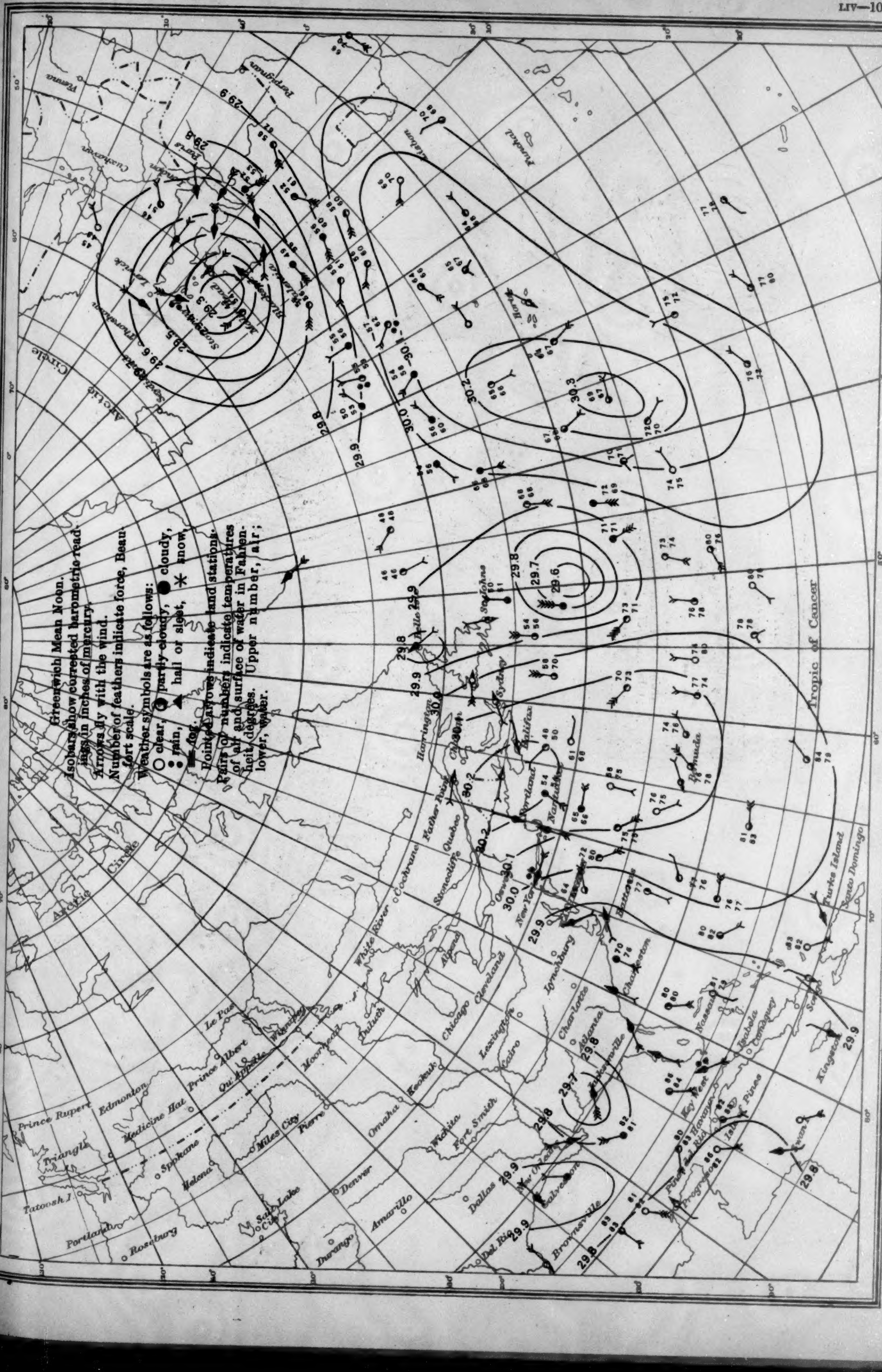

Chart XIII. Weather Map of North Atlantic Ocean, October 25, 1926
(Plotted by F. A. Young)